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PRACTICE IN SEWAGE DISPOSAL*

**The Latest Methods Employed from the Engineer's Side of the Question—Practical Results
Versus Theoretical Opinion**

By Henry C. H. Shenton

It might appear that so many papers have already been written upon the subject of sewage disposal that another on the same subject could not be required. The author's reason, however, for writing the present paper is that the practical, or engineer's, side of the question has generally remained untouched, while the scientific side has been amply discussed. Without in any way wishing to undervalue the work of the chemist and the scientist, the author is of opinion that it is now more than ever necessary for engineers who have to design the works and attend to the details of their construction and working to discuss the matter from a practical rather than from a theoretical standpoint. It seems strange that there should still be so many differences of opinion among leading authorities as to what is the best system of sewage disposal. To ask such a question would in reality be very much like asking what is the best method of locomotion. It depends entirely on circumstances.

Before considering the latest practice it will be well to briefly review the methods of sewage disposal in use at the present time all over the country. It is frequently almost impossible to say where one system ends and another begins. For instance, the difference between broad irrigation and downward filtration, or between intermittent downward filtration on prepared land and on earth and ballast filters, may sometimes be very slight. There are, however, two main stages in the process of sewage disposal which, whatever may be said to the contrary from a theoretical standpoint, are practically at the present time quite distinct except in exceptional cases.

The first of these stages is the removal of sludge from the sewage, and the second is the final purification of the sewage or effluent, and it is quite distinct from the first stage. Probably this is rank heresy from the chemist's standpoint. It is well known, for instance, that a considerable amount of purification may take place in a septic tank.

Practically speaking it will be of assistance to regard the two steps as distinct from each other, as, however useful the purification which takes place in a septic tank may be, no one would think of using one, if it were not for the fact that it will liquefy sludge.

FIRST STAGE

Turning, then, to the first stage—namely, the removal of sludge—there are at the present time several methods in use: (1) The natural precipitation of solid matters in tanks. (2) The same aided by chemicals. These older methods in their many different forms are too well known to need further description. It will be remembered that they leave all the sludge in the tank, and that this sludge has to be got rid of somehow. (3) The upward filter, which is an arrangement whereby sewage is made to rise through a bed of gravel or clinker about 2 feet deep, laid above a grid with a space underneath. Sewage generally runs through it for, say, one week, and then the flow is stopped and a space below the grid is cleaned out. Considerable anaerobic action takes place, whereby most of the sludge is liquefied. (4) The septic tank, either open or covered, in which the sludge is liquefied by anaerobic action. The effluent from any of these processes needs further treatment if it is to be discharged into any stream or river where foul liquid would be a nuisance. This further treatment is the second stage of sewage disposal referred to previously, and although it may be urged that in isolated instances crude sewage is treated on land or on coarse contact beds, this is not the general practice, and whatever may be possible in the future it has not yet been shown in practice that the processes referred to as the first stage can be done without.

SECOND STAGE

There are several processes for the treatment of tank effluent in the second stage which are briefly as follows:

*Paper read before the British Society of Engineers, April, 1904.

(1) Land treatment by broad irrigation, lateral filtration and downward filtration. The principle underlying all these methods is to bring sewage in contact with the nitrifying organisms which exist near the surface, chiefly in the upper 3 feet of the soil. It is clear that if any great amount of work is to be done sewage must filter through the porous ground in one way or another. If it merely flows over the surface without any percolation, of course the smallest possible amount of purification will take place. It must not, however, be assumed that no percolation takes place when sewage is merely made to flow over the surface of an ordinary field; percolation resulting in purification must take place to some extent. On the worst ground there is probably a layer of top soil or porous earth into which the sewage will soak to be displaced by the oncoming flow or to travel forward to lower areas of the ground. If sufficient area is allowed sewage may be purified on almost any ground that is not waterlogged; but it may well happen that the area required will be so vast that purification on bad ground will be impracticable, while it will frequently happen that on moderate ground the area required will still be enormous, and the probability of its ever being worked so that the sewage is properly distributed on to each area in turn will be very remote. With a weak sewage or filter effluent treated on a sufficient area of good land receiving proper attention there can be no doubt whatever that excellent results have been, and are being, produced. Also, a strong sewage may be satisfactorily treated by passing it through land two or three times or by applying a very small quantity of it to a large area.

(2) In the definition of fine filter the author includes filters consisting of such materials as burnt clay, ballast, clinker, gravel, etc., mixed with sand, and having a covering of loamy soil, such as those constructed formerly by Mr. Baldwin Latham at Barnet, or more recently at Carshalton, or such filters as those put in by the late Mr. Santo Crimp at Wimbledon. These filters, being under control and receiving better aëration than land, produced upon a much smaller area the same result as the best land. They are still doing excellent work and producing good effluents, and probably, in certain cases, are still as good as any method yet devised. Sewage is distributed over the surface, and passes slowly through the body of such filters. Where they fail it is merely a matter of overworking.

There are other fine filters, such as those filled with sand and gravel or similar material, which, provided they are not overworked and are properly aërated, will do good work. Generally speaking, however, far more sewage was put on to those filters than they could possibly deal with, or, in other words, the filter area was generally very much underestimated, with the result that they became foul and clogged. Far too much was expected of them, both by those who put them in and by those who worked them.

(3) Washed-out filters have been constructed to deal with special sewage in some parts of the country. They scarcely agree with what was stated by the author at the beginning of his paper as to all filters being used to deal with tank effluent only. The washed-out filter is generally used to deal with a heavy flow of trade waste, containing solid mat-

ters, until the surface is sludged up with organic matter. This organic matter is then washed out of the filter by an upward flush of water, or else the filtering material is renewed.

(4) The contact bed, as is well known, is a tank filled with some material such as clinker, which will form a home for the bacteria by whose agency the sewage is resolved into harmless chemical constituents. The difference between the contact bed and the filter is chiefly in the working. In the case of the filter the sewage filters straight through, while in the case of the contact bed the outlet valve is closed, and the bed is allowed to fill up and the sewage is held there in contact with the bacteria for the space of an hour or more.

(5) The continuously aërating filter is generally composed of large lumps of clinker or other material, with ample ventilation through its body. It is generally at least 4 feet deep, and the sewage effluent has to be distributed over its top surface in such a manner that there is in no place any continuous stream of liquid through the filter. The size of the filter must be such, and the distributing arrangements must be so arranged, that every drop of liquid passing through may make a very slow passage—say of twenty minutes' duration or longer—from the sprinkler to the outlet. The body of the filter is saturated, and the effluent runs out all round at the bottom, but there is no such thing as a stream of sewage through any part of it, and if the flow is increased to such an extent that there is a stream, or if one exists through the uneven working of the sprinkler, the effluent will be bad. It will be clear to anyone that the mere fact of tank effluent running rapidly over the surface of clinker covered with bacteria cannot be expected to produce purification; but that the slow passage of the liquid for half an hour or so over the same material is a very different matter, and it is this slow passage, and the thorough contact which it produces, which has to be obtained if the result is to be good.

SYSTEMS COMPARED

The author has made a careful study of existing sewage works in many parts of the country, and it has led him to the conclusion that each and all of the systems he has mentioned have their uses, and it is not too much to say that they have all produced good results in certain cases. This after all is not very remarkable, considering that the same biological principle underlies every recognized system of final sewage purification. If, for instance, sewage filters through 3 feet of suitable land, it probably will come out much better than it went in; but it does not follow that it is then fit to be discharged into a brook. This depends on the quality and quantity of the sewage, on the nature of the land, and on its condition. Hard and fast rules are most misleading. Such an effluent may be about as good as the effluent from a first contact bed, and if it were again passed through land it would probably be a great deal better, and would be improved in exactly the same way as the first contact bed effluent passed through a second contact bed would be improved. Again, it is very clear that if this twice treated effluent went through land for the third time, or if the second contact bed effluent passed through a third con-

tact bed, we should in both cases probably get a good effluent. The contact bed and land, in fact, would have performed exactly the same work—namely, that of bringing the sewage into contact with the nitrifying organisms by whose agency purification is effected. The same may be



FIG. 1.

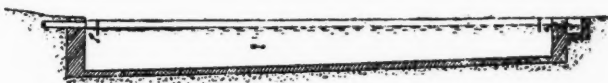


FIG. 2.

said of filters. The point is not whether land can purify sewage, or whether the contact bed or the filter can do it. They can all do it; there is no question of principle in the case, but one of practical convenience, and as the conditions vary in each case, hard and fast rules will certainly not apply.

CONSTRUCTIONAL DETAILS

Turning to details, the author thinks the septic tank needs most consideration as regards the methods for the first stage of sewage purification. The best methods of precipitation have been well thought out long ago, and are not generally economical or so suitable for ordinary works. The septic tank is used as a preliminary for land treatment, for filters, for contact beds, or for continuously aerating filters, and has to a great extent replaced the older methods,

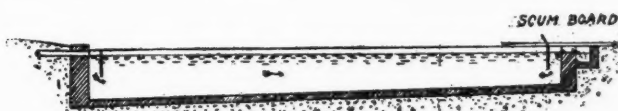


FIG. 3.



FIG. 4.

being more economical and a much better preliminary for the aerobic action to follow. There is not the slightest doubt, whatever prejudice one may at first have had against the septic tank, that it is practically a most useful, and even indispensable, part of the greater number of the smaller

sewage works recently constructed. It is only fair to state that the idea that a large mass of putrid sewage kept in a tank would be very objectionable does not seem to have been borne out in practice. Where a septic tank is not disturbed, there is practically no smell. An ordinary sewage screen or open channel full of crude sewage at the top of the works will generally smell much worse than any septic tank. This fact will be obvious to any unprejudiced person who inspects many works. The remark does not refer to plain open tanks, which are sure to be disturbed by the wind at times, and are, therefore, not to be recommended.

In the author's opinion the dimensions and details of construction of the septic tank need careful consideration by the engineer. At most places the depth does not exceed 7 feet, but the author is of opinion that it is possible that the depth of 7 feet might be increased with advantage. It is very evident to him that 7 feet is near the minimum depth for a septic tank, especially if that tank is only lightly covered. In such tanks the scum may at times be, say 3 feet thick, and 2 feet or 3 feet of sludge may also accumulate, which would reduce the capacity of the tank to practically nothing. There are, however, plenty of instances of tanks filling up in this way and recovering, and almost the whole of the solid matters in sludge and scum have been liquefied. If, however, the tank were, say, 6 feet deep or less, it would probably have had to be emptied, simply because it had suffered from a temporary fit of indigestion, and this would have been of no account if it had been deeper. If, for instance, it had been 10 feet deep, there would have been still 4 feet of liquid between the sludge and the scum.

Perhaps the most general practice at sewage disposal works has been to turn the old chemical precipitation tank into a septic tank; such a tank is often 5 feet deep at the inlet end, and 4 feet 6 inches deep at the outlet end. The first thing done has been to simply let the sewage run through it without any scum board or trapped outlet. Any amount of solid matter has come out with the effluent, but a great deal has been liquefied also by the septic action, with the result that the amateur-engineers of the district have been much pleased at the successful application of theoretical principles, and that a certain definite saving has been effected by getting rid of the sludge difficulty. The contact beds or filters, however, have later on become clogged, and the contact bed principle has been severely blamed in consequence. Later on the septic tank—or so called—has been found to be sludged up, and has had to be emptied, and the

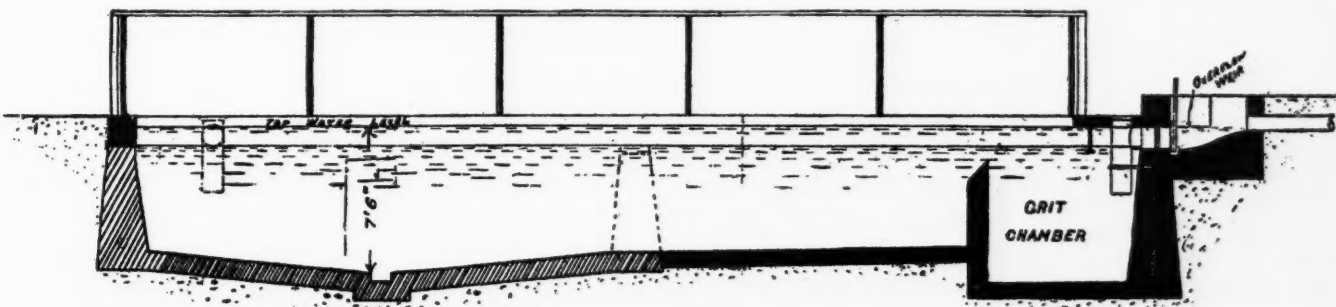


FIG. 5.

district councillors of the place where such occurs will tell you that engineers have still a great deal to learn on the subject of sewage disposal.

Fig. 1 shows a section of this hopeless arrangement, so often called a septic tank. It is altogether too shallow, and there is no cover to keep it from smelling or to prevent the wind breaking the scum. The inlet pipe may break up the scum to any extent, and the scum may go off freely at the outlet. It is an open cesspool, pure and simple. It is a little improved by the addition of scum boards as shown in Fig. 2, but these scum boards are very often far too shallow to prevent scum being given off. It would be very much better if the scum board or outlet pipe were carried down to the middle of the tank as shown in Fig. 3, where about 18 inches of scum and the same amount of sludge may accumulate in the tank without solids passing away in the effluent. But the tank will never be a good job unless it has

sufficient depth; this depth the author thinks should be at least 7 feet, as shown in Fig. 4. This will allow for the various changes which take place in a septic tank, and a liquid effluent, free from solids, will be the result, even if the scum is occasionally 3 feet thick, and the sludge also 3 feet thick.

The author had on one occasion to remodel some sewage disposal works, where the old chemical precipitation tanks were re-used, to form a septic tank, as shown in Fig. 5, and where the depth at the outlet was 7 feet 6 inches. After producing a liquid effluent for sixteen months the whole of the sludge at the bottom of the tank suddenly began to ferment violently, and formed such a thick scum for a few days that solid matters were given off at the outlet. During this action there was practically no sludge at the bottom. If the tank had been made deeper this temporary inconvenience would not have been experienced.

(To be concluded in February.)

FOUNDATIONS FOR BRICK PAVING*

Methods of Construction Used in Marion, Ind., as Told by the City Engineer—Various Forms of Foundation

By T. E. Petrie, C. E.

THIS subject having been assigned to me by your Committee on Brick Paving, I take great pleasure in giving you the experience our city has had in the different methods of constructing the foundation for its many paved streets and alleys. The city of Marion was one of the first in the State of Indiana to adopt brick as a paving material. The first brick street was built in 1890, with an increasing every year since. Last year was the banner year, as we laid 91,254 square yards, or six miles of brick pavement. This year, when all work is completed, we will have constructed 58,672 square yards, making a total of 311,583 square yards of brick paving for our city in the last fourteen years.

We have 122,933 square yards of asphalt, or about seven miles, making a total of twenty-four miles of asphalt and brick streets.

We have many miles of macadam streets, but are building less of macadam and more of brick every year. Unfortunately our stone in the locality of Marion is not suitable for macadam streets, as it disintegrates when exposed to the weather; however, we find that it stands up well, when used as a foundation for either brick or asphalt streets.

THE KIND OF ROLLER TO USE

In connection with concrete foundation I wish to state that before placing the concrete, the greatest care should be exercised in getting the sub-grade solid, and this should be done by a thorough rolling with a steam roller, weighing not less than ten tons; any soft or spongy places should be taken out and the excavation be refilled with suitable material.

The concrete that is tamped in place cannot be relied on to carry a heavy load over a weak place in the sub-grade. I

speak of this from experience, as our city, unfortunately, owns a seventeen-ton steam roller, and I have found in a few places where this roller has broken the concrete foundation and left very bad depressions in our asphalt streets. It is well to state just here, that one of the most difficult tasks I have is to select a route for the steam roller to go from one piece of work to another to avoid passing over the various streets that will not safely bear up the roller. Unfortunately, the gravel about Marion cannot be rolled with our steam roller, as it shoves ahead, and the roller founders. I have tried a six-ton horse roller, and then followed with a ten-ton roller, but this would founder and I had to give up the idea of rolling the gravel with a steam roller. In passing our steam roller over a brick street that is laid on a gravel foundation the paving gives down, thus showing that the sub-grade and foundation should be solidified by passing over its entire surface several times a load equal to the heaviest load that is liable ever to be placed on the surface of the said pavement.

Last season we built about one and one-half miles of brick paving on gravel foundation, to cheapen the construction. As the lots run lengthways to the improvement the entire depth of pavement was sixteen inches. The foundation was built in two six-inch layers, both being wet and rolled with a six-ton horse roller, and the sub-grade being rolled with a ten-ton steam roller. These streets were built on clay soil and had scarcely any under drainage, with the exception of about three hundred feet, where a large brick sewer had been built several years ago. The streets are in as good condition today, as when completed. All of the brick alleys that have been paved in our city have a ten-inch gravel foundation, with a few exceptions where boulders have

* A paper read before the recent meeting of the Municipal League of Indiana. Mr. Petrie, the author, is the City Engineer of Marion, Ind.—[EDITOR.]

been used, being bedded into the gravel and covered with a sand cushion. However, I am not favorable to this method of construction, as the depth of the sand cushion is not regular and it is impossible for the surface to remain smooth under this method.

WHERE STONE IS USED FOR A FOUNDATION

Now turning back to stone, used for foundation, I must say that Marion has but few square yards of brick pavement on concrete—only 11,592 square yards out of the total of 311,538 square yards. The most of our streets are built on crushed stone foundation. All brick streets, on stone foundation, previous to 1903 were built in the following manner: After the sub-grade was made, and rolled with a six-ton horse roller, eight inches of crushed stone was placed thereon, after which the entire surface was covered with about two inches of sand and washed in, and then rolled with a six-ton horse roller, when the street was ready for the sand cushion. This method of construction left the depth of the sand cushion very irregular, and to leave the flushing and rolling to the ordinary contractor, it is but poorly done. The voids are not nearly filled, and after the street is completed, often settles in places, which is caused by the sand finally sifting down and filling the voids, the pavement following.

A horse roller is only a makeshift in preparing a foundation for the pavement, as the horses will dig and loosen the stone fully as fast as the roller compacts it.

METHODS USED IN CONSTRUCTION

The sub-grade is prepared and thoroughly rolled, with the city steam roller, care being taken to see that all soft and spongy places are made solid by excavating and filling with proper material. Now we are ready for the first coat of stone, which is four and one-half inches in thickness, and rolled until the stone ceases to move or shove under the roller. This layer of stone is used of sizes from two and one-half to three inches—any slabs or flat stone that happen to go through the crusher must be broken before this course is rolled. Unless an inspector is at hand to see that these flat stone are broken before rolling, the contractor prefers letting the roller do the breaking, and those that the roller do not break his men will break, thus saving considerable extra labor. After this rolling a second layer of stone is placed thereon, varying in size from three-quarters of an inch to one and one-half inches, and to a depth that, after being thoroughly rolled, will be eight inches—this last course is usually rolled from six to eight times, and in preparing and rolling this course its surface is tested to see that it is regular and to conform to the contour of the finished pavement, and if found to be lacking in material more stone of this grade is called in and the entire surface is rolled and ironed smooth. Now we are ready for the stone screenings, which is placed about one-inch thick over the entire surface.

Then the steam roller passes over the surface about twice

when the street sprinkler precedes the roller; this sprinkling and rolling is kept up until the entire surface becomes smooth and hard. To obtain this result usually requires about six times over, and all places that cannot be rolled must be thoroughly wet and tamped with a seventy-five pound rammer.

This makes, approximately, eight and one-half inches of stone, and, as the entire depth of the pavement is to be fourteen inches, this leaves, approximately, one and three-quarter inches for sand cushion, the brick being three and three-quarter inches.

FOUNDATION FOR STREET RAILWAY TRACK

As my subject is on foundations I shall still keep under the wearing surface and proceed to explain the method of construction of a foundation for a street railway track as used in our city, this being a part of the foundation for the pavement.

The sub-grade is made eight feet wide and twenty inches deep, measuring from the surface of the finished pavement, after being thoroughly rolled—and here, as on the rest of the sub-grade, great care is to be taken to have a solid sub-grade.

After the sub-grade is prepared it is covered with a layer of stone of the same size as is used for the second course on other parts of the street. The thickness of this course must be seven inches. After being thoroughly rolled and in order to get this surface smooth the grade is tested—after the roller passes twice or three times over—by using a string stretched tight from curb to curb, and measuring down from this string thirteen inches; if more stone is needed it is spread, and if the stone is too high in places it is raked to the low places or taken away; then the roller proceeds, rolling the foundation until it is smooth and hard. Then the track is laid and ballasted with good coarse gravel, and the space between the ties, both in and outside of the rails, is filled about one inch above the top of the tie. This gravel is wet and then thoroughly tamped with a heavy hand tamper, at all times keeping the gravel between the ties fully one-half inch above the ties, thus leaving a two-inch sand cushion over the ties and only one and one-half inches between the ties, and if the brick is well rolled or tamped the surface of the brick will remain smooth and show no depressions between the ties.

We have track work where stone is used between the ties, and by experience, I find that the voids between the stones are very seldom filled the best that they can be tamped, thus causing the brick to settle between the ties, both between and outside of the rails. This experience caused me to use the gravel filler. Unfortunately for the city, the I. U. T. Co. has a franchise not requiring it to lay its tracks on a bed of concrete. If concrete were used, all depressions between ties would be avoided. However, we are here to deal with conditions as they are and what our former city officials have prepared for us.

DEVELOPMENT OF BITULITHIC PAVEMENT*

The Story Told by Its Inventor at the Annual Meeting of the Massachusetts Highway Association, Boston

By Frederic J. Warren

PRELIMINARY to discussing the bitulithic pavement before this association I feel that I should express my appreciation of the important part which the members of this association have had in its development. Many suggestions have been made from time to time by members of the association which have had a considerable influence in the development and improvement of the work, and it was owing to the support given to the theories advanced by its members that the development was taken up on broader lines than might otherwise have been expedient or possible. It was about four years ago that it occurred to the writer and his brothers that it was possible to combine stone and bitumen in a manner which would retain all of the best features of the asphalt as well as the macadam road, and accomplish many advantages which were not present in either of them. We had previously devoted some years to the manufacture of bituminous cements and the construction of asphalt pavements, and were quite familiar with the development which had taken place along these lines, and realized the deficiencies which existed in the asphalt pavement, and sought to overcome them so far as possible. Experience had indicated that a radical change in the theory and method of construction employed in the asphalt pavement was essential to the accomplishment of the best results in road building.

LABORATORY AND EXPERIMENTAL WORK AT CAMBRIDGE

Before making any practical tests on streets along the lines now employed in the bitulithic pavement, I invited some twenty superintendents of streets and city engineers, mostly members of this association, to our factory at Cambridge, to aid and give their advice in carrying on some experimental work. Prior to that time I had had no experience whatever in the building of macadam roads and many points were picked up from the members of this association which had been gathered through their practical experience in building what are unquestionably the best macadam roads, I believe, in this or any other country. I can say without hesitation that the endorsement given to the experiments by the members of this association, who themselves had a reputation as road builders second to none, had tremendous weight in the adoption of the pavement by other communities, and the fact that the pavement had been adopted in this State to an extent vastly in excess to which the asphalt or brick pavements had been adopted, brought it at once to the consideration of officials throughout the country.

The theories of construction have been discussed so thoroughly in the engineering papers throughout the country that there is little more to be said. At a meeting of the

Boston Society of Civil Engineers, in January, 1902, which I had the pleasure of addressing through the courtesy of your president, I pointed the following essential conditions as necessary in the development of a bituminous pavement.

CONDITIONS NECESSARY TO PRODUCE PERFECT PAVEMENT.

In order to maintain uniformity and enable one to improve and perfect any bituminous pavement, it is quite essential to have recourse to a chemical and physical testing laboratory, and to record all conditions present. Such a laboratory should not only examine materials to be used, which examination justifies an opinion of their combination or use, but, after a mixture or combination has been determined upon, a sample should be taken daily, or at frequent intervals, and it should be separated into its parts, and the actual conditions present in the mixture, as it is actually laid, should be carefully recorded, and the exact location where the particular sample is taken, should be noted.

This record acts in affecting the pavement in important ways. It gives a sure test of whether instructions are being followed, and makes every employee careful, for carelessness will surely be detected under this system.

It also provides a record of the exact conditions present, as the pavement mixture is actually laid, as against and to be compared with the record of the exact kind and quality of the commercial materials directed to be used. This system has made it possible to lay fairly good bituminous pavements out of relatively poor bituminous cement, and under principles which have proven deficient. The record is an invaluable aid in measuring the change in the physical condition of the wearing surface, and the bitumen itself under exposure to weather.

PRINCIPLES CLOSELY FOLLOWED

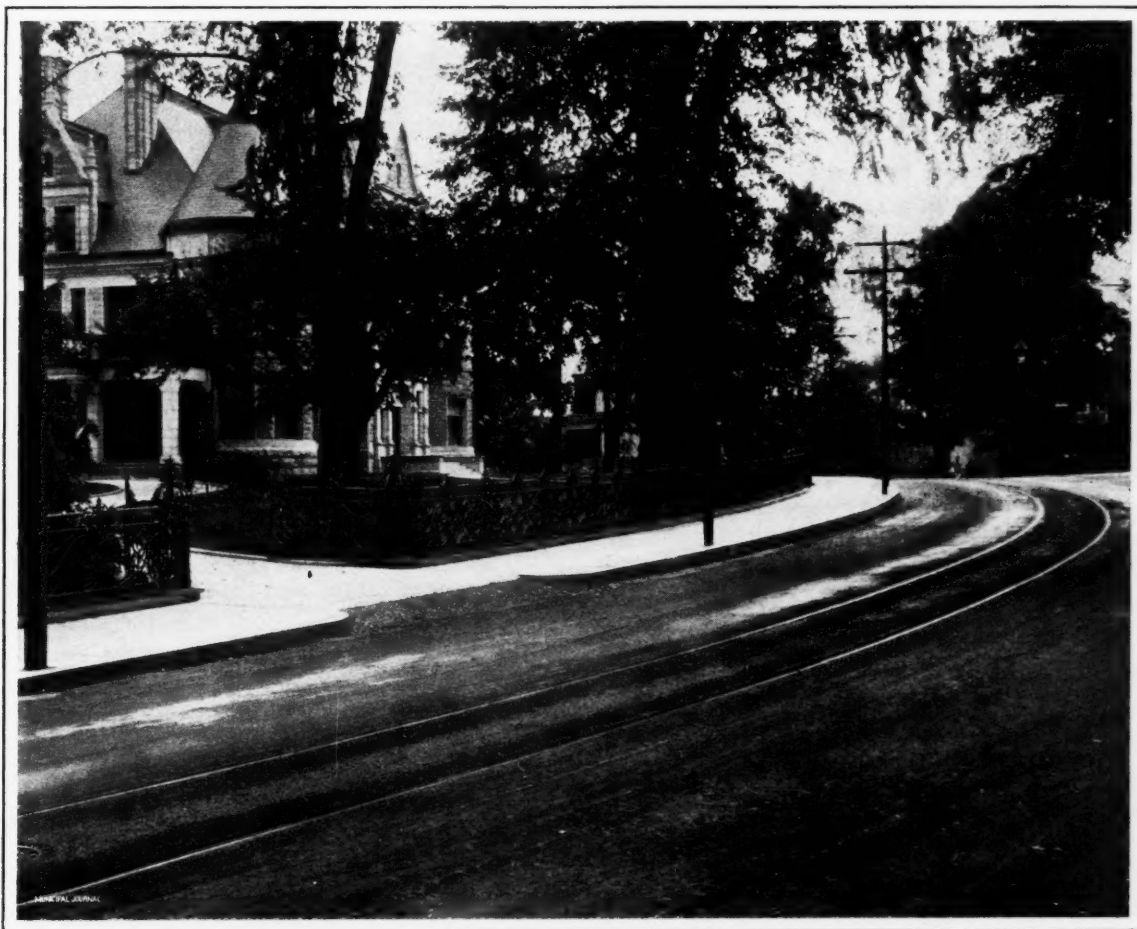
In the development of the bitulithic pavement we have consistently adhered to these principles. In order to take care of the development of the pavement the laboratory has been greatly increased, and the expense of maintaining the laboratory is no inconsiderable item. In maintaining a complete record of everything that is done, and in analyzing mixtures after they have been made, and recording the exact conditions present in each individual piece of pavement which has been laid, it has been necessary to greatly increase the force of chemists and experts, and to educate a large number of men. I am safe in saying that had it not been for the system which we employ of carefully following the chemical and physical conditions by daily laboratory tests, which system caused us a loss of \$25,000 the first year we undertook the development, it would have been impossible to have approximated the uniform conditions which we have secured throughout the country.

In previous papers I have pointed out that it is far easier and more practical to measure the changes which take place

* A paper read before the recent annual meeting of the Massachusetts Highway Association at Boston, by the author, Mr. Frederick J. Warren, President of the Warren Brothers' Company.—[EDITOR.]

in bitumens and bituminous mixture by physical than by chemical tests, and that it is important to know the nature of the bitumen, and to so use it as to prevent the changes from taking place. We have been laying the bitulithic pavement a sufficient length of time to be able to approximate the change which takes place in the bitumen as actually used in the pavement, and we find that in practice the change is even slower in the dense mixtures than we had anticipated or estimated. While it is possible by the apparatus available to measure the change which would take place by the loss of less than one-tenth of one per cent. of the oils in the bitumen, which is equal to about one one-hundredth of one per cent.

this association that in the bitulithic surface the materials are graded as to sizes, using a large proportion of the largest size used, and a sufficient quantity of smaller sizes, in predetermined proportions, so as to fill in between the larger sizes, and grading the sizes from one five-hundredth of an inch, and in some cases one one-thousandth of an inch, up to the largest size, so as to get the greatest possible density, the whole being commingled in apparatus especially prepared for the purpose, the greatest care being taken to use each size by exact weight. The largest size may be varied somewhat to meet varying conditions of traffic, but in any case where the materials are carefully graded a sufficient



THE BITULITHIC PAVEMENT AS LAID ON ONE OF THE FINEST RESIDENTIAL STREETS OF SPRINGFIELD, MASS., BY THE WARREN BROTHERS' COMPANY

of the entire mixture, we find by taking a sample a quarter of an inch below the surface of the mixture that there has been practically no change whatever in the softness of the bitumen during the something over three years since the pavement was laid. It is a well-known fact that the bituminous materials themselves will age, harden and deteriorate very rapidly when exposed in thin films, and in the old method of combining bituminous pavements the process was to combine them in such a way that there was a series of thin films surrounding the mineral particles, and the density was not acquired which would prevent the evaporation and oxidization of the bitumen.

GRADING OF MATERIALS IN FORMING BITULITHIC SURFACE

I believe it is thoroughly understood by the members of

quantity of bitumen can be used to thoroughly fill the space which is left after properly grading the materials. The softness of the cement may be varied somewhat to meet the varying conditions of traffic. On a street very heavily traveled it is safe to say that the bitumen would many times outlive the wear which the stone would take, and under such conditions it is often advisable to harden the cement, while on light traveled streets, or remote suburban streets, where heavy traffic would not wear the stone so rapidly, it is more important to have a softer cement which will give greater life to the structure. From our past experience I do not hesitate to say at this time that under very moderate conditions of traffic a bituminous structure can be combined along the general principles of the bitulithic pavement which so

far as deterioration from weathering is concerned, would last one hundred years, while it is well known that in the asphalt structure, such as is commonly used, the pavement itself weathers at from five to fifteen years, even when not subjected to traffic.

HOW SOME LESSONS WERE LEARNED.

On the first work which was done the material was separated only into four general sizes, although these four sizes were very carefully approximated as to their detailed sizes. We found that this method did not accomplish perfect uniformity, and the present commercial apparatus for laying the bitulithic pavement separates the material into six different sizes, and each one of these sizes is carefully approximated as to the details of its sizes. The experiments which we made prior to the building of the pavement on a large scale indicated that the exact size of the very fine material which goes into the wearing surface of a bituminous pavement has great relation to the physical condition of the pavement itself. Experience has proven that this theory is correct, and it makes a great deal of difference in the physical appearance and life of the wearing surface as to whether two per cent. of material one five-hundredths of an inch is used, or whether as a substitute two per cent. of material one one-hundredth of an inch is used. In fact, we have proven conclusively that the finest carbon flakes if used to the extent of sixty per cent. of carbon flakes to forty per cent. of bitumen will deaden the bitumen to such an extent that it is as lifeless as putty, the material being so minute as to size, and there being so much surface to coat, that the bitumen in its subdivided condition fails to have the binding properties which are necessary to properly cement the mineral matter together. As a certain amount of very fine material in the bitumen is necessary to stiffen it and give it a body, it is of the utmost importance that great care should be taken in the use of the finer particles so as to produce the requisite conditions, and we find it necessary to prepare the cements with the utmost care, so as to make them uniform in all of their conditions. A varying amount of carbon or fine matter will make a great variation in the physical appearance of the cement itself, and as bituminous materials are generally used and judged by their physical appearance, and as all bituminous materials as produced vary in purity, it is not possible to get uniformity of results, without a knowledge of the chemical and physical properties present in the particular bituminous cement to be used. Of course, in addition to the physical condition of the bitumen, due to its purity, there are great variations which may show in a pavement, owing to the difference in flexibility, viscosity, brittleness, ductility and adhesiveness, and there are a great many tests which are necessary to be applied in determining the feasibility of the use of any bituminous material, and after the class which may be advantageously used has been determined, it is necessary to use it with the greatest care as to temperatures and other conditions, in order to get uniformity of results in the pavement.

ADVANTAGES OF BITULITHIC FOUNDATION OVER HYDRAULIC CONCRETE

In earlier papers I have pointed out the great advantage

of a solid foundation of rolled stone bound together with bituminous cement, over hydraulic concrete. These advantages are especially true as to New England, where the natural foundation is generally solid and will permit of proper rolling. The rolled stone foundation permits the overlying course to enter and bind in to the foundation and aids in holding the top bitulithic surface in place. The experience which we have had with the bitulithic pavement is in accordance with the experience which has been had in recent years in building thinner macadam pavements. We are firmly of the opinion that great depth of foundation is not essential where proper rolling is possible, and in many cases I am of the opinion that it is impossible to build any more substantial sub-foundation than is obtained by the rolling of the natural soil, in connection with proper drainage, and owing to the carelessness of the men employed and carelessness in rolling, I believe it often happens that a poorer pavement is the result where excessive depth is used. This is especially true where the run of a crusher is used in building the foundation, which results in lack of stability, it being understood, I believe, by all practical road builders that it is quite essential to have stone of approximately the same size in each strata in order to have them properly rolled together, diminishing the size from the bottom to the top. In some sections it is impossible to thoroughly roll and get a compact sub-foundation, and where this is true a hydraulic concrete foundation is essential. Where hydraulic concrete foundations are used it is always advisable to overcome the tendency to moving or sliding of the top on the foundation by tamping into the hydraulic concrete foundation while still fresh stone of about $1\frac{1}{2}$ " in diameter, about half covering the foundation, and tamping the stone to about half its depth into the foundation, thus furnishing a binder which will weld the wearing surface into the foundation itself. In this way the tendency to slide is overcome. The concrete foundation, however, at its best, does not facilitate drainage to the same extent that the rolled stone foundation does, and it is my opinion that under the best possible conditions a pavement laid on a rolled stone foundation will have a greater life than one laid on concrete under any condition of construction.

THEORIES AND RESULTS

The theories which have been worked into the construction of the wearing surface of the bitulithic pavement are:

- (a) The placing of the wear of a pavement on stone used in predetermined proportions.
- (b) The binding of the stone with a bituminous cement so as to approximate the solidity of solid stone.
- (c) The reduction of voids.
- (d) The use of softer bituminous cements.
- (e) A heavier coating of cement around each grain of the mineral ingredients.

The resulting pavement is now in such considerable use throughout the State that it is hardly necessary here to point out its advantages. I think most of your members are more or less familiar with its physical appearance. In view of the fact that the pavement is distinctively a Massachusetts production, you may be interested to know the ex-

tent of its development throughout the country. It was pointed out at your meeting in May, 1902, by my brother, that it had been used in six cities in New England; namely, Pawtucket, Holyoke, New Bedford, Cambridge, Lowell and Brockton, and also in Salem, N. J. The entire area laid in these cities amounted to 16,400 square yards. Since that time we have laid in these same cities 147,540 square yards, and we have laid the pavement in fourteen other cities of Massachusetts to the extent of 204,921 square yards, and there is now a total of 310,297 square yards in use in this State. While this area does not equal the quantity laid in the city of St. Louis alone, I am more proud of its extensive use in this State than of the development elsewhere.

The development throughout the United States has been as follows: Alabama, 1 city, 33,648 square yards; Colorado, 1 city, 13,512 square yards; Georgia, 1 city, 19,825 square yards; Indiana, 4 cities, 43,954 square yards; Kansas, 1 city, 63,234 square yards; Kentucky, 3 cities, 49,080 square yards; Louisiana, 1 city, 99,502 square yards; Maine, 1 city, 11,192 square yards; Massachusetts, 20 cities, 310,279 square yards; Michigan, 12 cities, 231,233 square yards; Minnesota, 1 city, 10,853 square yards; Missouri, 2 cities, 462,538 square yards; New Jersey, 4 cities, 106,924 square yards; New York, 9 cities, 161,310 square yards; North Carolina, 2 cities, 66,487 square yards; Nebraska, 1 city, 28,069 square yards; Oregon, 1 city, 73,884 square yards; Ohio, 5 cities, 109,058 square yards; Pennsylvania, 3 cities, 107,486 square yards; Rhode Island, 3 cities, 44,885 square yards; Tennessee, 1 city, 139,500 square yards; Virginia, 1 city, 38,777 square yards; Washington, 1 city, 33,200 square yards; Wisconsin, 1 city, 44,566 square yards; Nova Scotia, 1 city, 37,167 square yards; Ontario, 5 cities, 101,557 square yards; Quebec, 1 city, 6,843 square yards.

The total amount of bitulithic pavement now in use is

equal to about 200 miles of 18' roadway. So far as I am informed the cities which are now making use of the pavement are considering its use in larger quantities in the future. The total amount of contract for bitulithic this year aggregates more than \$3,000,000. Two cities in the West where the pavement has not been laid have already recommended it for next year to the extent of over 500,000 square yards, and from present indications the amount of yardage which will be laid during 1905 will exceed 2,000,000 square yards.

The public has been so well pleased with the results that it has been impossible for us to undertake a large number of small contracts through the country. In this stage we have made every effort to do all the work offered, but in remote sections we have felt that we could not afford to take small contracts, as it was impossible for us to develop an experienced organization faster than we have.

In the laying of this vast amount of work we have noted, as have the most intelligent road builders, that the foundation is a very essential part of a good pavement, and that good drainage and a proper crown are essential to a satisfactory street improvement. I am of the opinion that in country districts where the sub-soil is gravel, that a thin bitulithic surface to the depth of not to exceed an inch or an inch and a half might offer great advantages in economy and durability, and I look forward to some experiments along this line at no distant date. I should hardly like to be in the position of guaranteeing the results, but under such conditions I believe the possible advantages offer many inducements toward making experiments where a cheap but durable road is required. In laying a thin structure of this class it will be necessary to have good natural drainage to avoid upheaval in the winter, but I believe that good gravel will afford all the drainage which is necessary and all the foundation which is necessary for country roads.

PROFITABLENESS OF PUBLIC OWNERSHIP

Not only has the Water Department of Cleveland, Ohio, which is owned by the city, as shown in its report for 1901, furnished water cheaper throughout its history than nearly every other city water works, and especially any private water company in the country, but it has the following financial exhibit to make:

The city paid to the water works prior to 1891 interest charges of \$3,940,000 and redeemed between 1878 and 1881, \$925,000 of bonds. Interest on the latter at 4 per cent. up to date, would have been \$888,000. The total of these items amounts to \$5,753,000. On the other hand the city has never paid for the water obtained for public purposes and for fire protection. For these purposes the private plant at Indianapolis received \$45 per hydrant, and in New Orleans, Memphis and Omaha \$60, to say nothing of receipts from water used in schools and public buildings. Applying this rate of \$45 per fire hydrant as a reasonable charge now, for both fire purposes and all other public uses, although it would have been low fifteen years ago, the value of water furnished

by the city for city purposes and for fire protection would be computed at \$4,368,000.

The department also had outstanding on Dec. 31, 1903, \$3,555,000 of bonds. This and the net revenue from the city as above, amounts on the above basis to \$4,940,000, or only a trifle more than one-half of the present structural value of the plant. Thus the water works, out of its net revenue, has paid the interest on its plant and half the cost of the plant. There is no sinking fund, but bonds are renewed as they mature. The security, however, is kept sound by the fact that for every dollar that goes into the plant for bonds another dollar in the past, and more than a dollar in recent years, has gone into the plant from net earnings.

Since 1890, \$6,547,039.55 have been spent for construction and improvements, aside from operating expenses, interest and repairs, but the increase of indebtedness has only been \$1,780,000. The remaining \$4,767,049.55 represents earnings of the department that have been devoted to meeting depreciation and to making improvements in the plant.

MUNICIPAL WASTE

Methods of Its Disposal and Reduction—Conclusions Reached After Investigating Systems of Various Cities—Municipal Ownership

By John H. Simon, M.D.*

As a member of a sanitary committee appointed to investigate the disposal of municipal waste and the various methods of reduction, with a view to making recommendations for the city of St. Louis, my experience during an inspecting tour of a number of cities proved highly instructive in regard to the collection and final disposition of refuse matter and garbage.

The word *garbage* used here is taken to mean table refuse only; that is all refuse animal and vegetable matter from the kitchen. *Swill*, which in the East is synonymous with garbage, is here taken to mean the excess fluid portion of the garbage only, whether it is contained essentially in the garbage itself as exudation from vegetables, or has been added by the householder. Dishwater, slops and all filthy liquids are included in this term. Rainwater falling into uncovered receptacles for garbage is also included. In some cities, particularly where garbage and refuse are reduced by incineration, the ordinances provide that garbage must be drained before being put into the legal receptacle.

Rubbish, implies all waste material, excepting ashes, garbage and building waste, and the sweepings from streets; all substances commonly called trash, and considered usually as valueless stuff. It is divided for obvious reasons into combustible and non-combustible rubbish.

Tankage, from the fact that it has been cooked or digested in large cylinders or tanks is the solid matter of garbage left after the water has been extracted. It forms the basis of the fertilizer.

The problem of how to dispose of garbage scientifically is just now only beginning to be solved. There is no system of disposal which gives entire satisfaction. Many different methods have been tried with varying and for the most part meagre success. The natural disposition of kitchen offal is feeding to domestic animals. This is the method followed in isolated households, in rural districts and in the smaller villages where chickens, swine, and sometimes even cattle presumably thrive on its consumption. It is conceded by most farmers and cattle raisers with whom I have spoken that garbage fed cows give a poor quality of milk, but there is no evidence that fresh garbage, when fed to swine, produces anything but good pork, and, indeed, there is no reason why it should not, especially if corn is used for the final fattening. As villages grow into towns and the amount of refuse becomes a factor to be reckoned with, we find communities resorting to the system of *dumps*, the first attempt to dispose of offensive waste and at the same time to utilize it—that is, by filling in low-lands. This method of disposal is not offensive, as might be supposed at first glance. The garbage is usually mixed with a large percentage of ashes, which act as an absorbent and diodorizer. Observa-

tions made in Louisville and Montreal indicate that no more than 25 per cent. of the total mixture gathered consists of garbage proper. When this material is used as filling, the town as a rule employs a man at each of the dumps to spread over it a thin layer of lime or some combination of carbolic acid, and the whole mass is finally covered with a clean earth. This method, of course, is very unsatisfactory and gives rise to many complaints, more especially during rainy weather and in places where the refuse is dumped into holes or abandoned quarries containing water. In Montreal, owners of low lands who apply for filling, are compelled to have them pumped out first if they contain water. The system if, indeed, it can be called a system, has nothing to recommend it, except the low cost of disposal, there being practically no expense incurred, except in the hauling, and it is not in vogue in progressive cities.

The dumping of offal into streams is manifestly the worst offense of all. It is a dangerous procedure, a menace not only to the health of the town which thus deposits its garbage, but to the other communities as well. It is the earnest hope of sanitarians throughout this country that the ultimate result of the Chicago Drainage Canal controversy will be rigid national legislation against the reckless pollution of streams.

As towns grow into cities the problem becomes more intricate. With the increase of population comes a corresponding increase of refuse material, and more than a corresponding increase in the danger to the health of the people from unremoved putrescible garbage. The collection itself of offal becomes a serious proposition. So that sooner or later every city is confronted by the question, "How shall we dispose of our refuse most effectively, most economically and with the greatest sanitary precaution?"

Efforts on the part of health officers and others, principally the officers of street cleaning departments in large cities, to answer this question, have resulted in the invention of various processes for the reduction of garbage, all of which are more or less defective, and all of which are based on one or two qualities essentially inherent in all garbage.

Garbage is (1) *useful*, or at least something useful can be extracted from it, and (2) it is *offensive*.

In casting about for a system which would get rid of garbage effectively and at the same time economically, certain early investigators evolved the plan now called the *utilization* process. Others impressed more by the offensiveness of garbage and actuated by an honest intention to dispose of garbage in a more sanitary manner devised the plan of *incineration*.

It was principally to study the relative merits of these two methods that I investigated the systems of Louisville, Montreal and Minneapolis—which have adopted the plan of in-

* Health Commissioner, St. Louis, Mo.

cineration—New York and Washington, which dispose of their garbage by utilization. From these investigations deductions have been made with a view to giving the city of St. Louis the least imperfect and most effective, most economical and most sanitary disposal of municipal waste known at the present time.

The cardinal points which have been positively determined are:

1. Garbage cannot be utilized if it is mixed with rubbish and ashes. Hence separation must be made either by the householder (primary), or by the reduction plant itself (secondary).

2. Garbage proper, unmixed with combustible rubbish, cannot be incinerated.

3. Collection and hauling of garbage can be accomplished without any odor in actual transport.

4. Disposal of rubbish can be practically self-sustaining.

5. (a) Odors will be emitted from any utilization plant, hence it should not be operated in any locality where there is objection on the part of citizens, whether these odors be unsanitary or not.

- (b) Odors do not emanate from a properly constructed incinerator, provided the garbage is mixed with sufficient combustible refuse and sufficient fuel is used in the process of burning.

6. Clean ashes have a distinct value and may be utilized to advantage.

With these facts clearly established, I submit the following recommendations, based upon my humble judgment as to their significance, subject perhaps, to many revisions and alterations, for I realize fully the intricacy of the problem.

First—The rigid enforcement of *primary separation*.

This has been the *bête noir* of all the cities visited. Citizens must be educated to the importance of this regulation. It is not, as is supposed in some quarters, an impracticable undertaking, nor does it materially inconvenience the householder. New York has practically solved the problem. There will of necessity be protests and murmurings of discontent from some of those who have been brought before the courts for violation of the separation ordinance, but the great majority of the people are intelligent enough to realize the utter necessity of such regulation and will abide by it once they have witnessed the results.

Primary separation is also the key to the proper collection of garbage and without it any system, however meritorious otherwise, will fail.

It is the *pons asinorum* in the study of the disposal of a great city's waste and those who can must cross it.

Second—The daily collection of garbage.

Garbage when fresh is clean and has little or no odor. It is only when it has matured and become putrescent that it is offensive. The real nuisance about a garbage receptacle is the amount of swill it contains; and the proportion of filthy fluid is increased by standing, particularly if the receptacle is left uncovered and exposed to the rainfall. In the winter season perhaps the need for collection is not so apparent, but during warm weather a garbage pail which has been filled for more than one day is unquestionably a nuisance and a menace to health.

Householders should be instructed to keep receptacles clean as far as possible, and to drain off the swill before placing their garbage out for collection. It may seem absurd to speak of keeping a garbage receptacle clean, but with daily collections it is not unreasonable to provide, as Minneapolis has done, that they shall "be cleaned as often as may be necessary to prevent such receptacles or the contents thereof from becoming a nuisance."

The question of the kind of receptacle, its size, whether it be made of wood or metal, etc., is a minor consideration. Sufficient is that they be durable, water-tight and provided with a suitable cover to keep out rain and snow, and to prevent animal scavengers (cats and dogs) from scattering unwholesome refuse about the premises.

Third—The utilization plan of reduction.

The experience of other cities has demonstrated the fact that incinerators fail to incinerate, excepting where only moderate amounts of garbage are to be disposed of and where proper fuel is cheap. The kind of fuel varies in different localities; wood, coal, coke, charcoal, oil and gas have been tried. Under the most favorable conditions one pound of fuel will evaporate only eleven pounds of water. Eighty per cent. of city garbage consists of water.

Inasmuch as all utilization plants are productive of more or less offensive odors, reduction works should be located either outside of the city or upon a site where there would be no annoyance to resident citizens.

In the matter of hauling garbage, I recommend for a city like St. Louis, that receiving stations be established in the city, consisting simply of street railway switches where the containers can be placed upon flat cars. The proper wagons for this purpose would be still water-tight boxes, removable from the running gear, such as are in use in Washington. These boxes or tanks could be made to appear entirely inoffensive by being frequently painted over with a coating of asphalt, one or two men being constantly employed for this purpose. Just as in Washington, each driver should haul his load of garbage to the switch or station, the full wagon box should be removed by a crane or pulley, and an empty one deposited in its place. The flat-car loaded with the two tiers of boxes (to all intents and purposes like any other boxes), should then be taken to the reduction plant and a flat-car containing empties brought back on the return trip.

Under this arrangement there would be no long strings of offensive carts driving through busy thoroughfares, the hauls would be very short, and daily collection of garbage would be not only possible, but easy. In addition to this the cost of collection and hauling would be very materially reduced.

Fourth—Incinerating furnaces.

From a sanitary standpoint there is as much danger lurking in dry refuse as there is in garbage. We need only to think of the many possibilities of infection from tenement-house wastes, paper, rags, clothing, old shoes, mattresses and a thousand other articles which are often the cause of propagating communicable diseases, to be convinced that rubbish should not be indiscriminately dumped in vacant lots. Most of this should be destroyed by fire. Under

proper sanitary regulations, the valuable junk material contained in ordinary rubbish might be recovered. In New York the privilege of sorting this kind of waste is sold to a contractor for \$250 a week.

Incinerators of approved pattern should be installed in the city. They should be large enough to be used for the incineration of garbage plus rubbish, if occasion should arise to make this necessary.

Difficulties might arise which would compel the discontinuance of the utilization plant, and even though the cost of fuel should be excessive, the city would have at least a temporary means of disposing of its garbage. Should nothing ever occur to make such action necessary the disposal of rubbish can at all times be reckoned as paying for the cost of operating a platform conveyor and incinerator itself.

Fifth—It can be stated on the authority of those who

have made experiments in this line, that clean ashes have come into great demand, bringing a return of from five to twenty-five cents per load of one cubic yard, and sometimes much more. Mr. C. Herschel Koyl, who has contributed an exceedingly interesting and able article on the utilization of clean ashes in New York, says:

"It is certain at least that if the city's output can be delivered at the department dumps or at other convenient places, in proper condition, the use of it for various building purposes for which it is known to be suitable, will almost equal the total supply for nine months of each year; and it is possible that the manufacture of ash into brick and concrete may become at an early date a considerable industry and make clean ashes an article of commerce."

For reasons which I have given at length elsewhere, I have concluded that municipal ownership of a reduction plant is not feasible in practice.

REPAIR OF STREET PAVEMENTS

In Rochester, N. Y., repairs to pavements during the year, except repairs to sheet asphalt pavements, were made by employees of the Street Department, under the direction of the Street Superintendent, and all the records were kept in that department as heretofore. These records show an expenditure of \$2,318.18 for repairing and resurfacing macadam streets; \$763.80 for repairs to Medina stone streets; \$420.67 for brick streets and \$8.11 for cedar block streets, also \$6,486.03 for grading and improving unimproved streets.

The repairs to sheet asphalt pavements were made by contract and the measurements and estimates by employees of the Department of Public Works. Cost of repairs to asphalt pavements was as follows:

Trinidad Lake Asphalt:

9,187.75 sq. yds. resurfacing at \$1.28
per sq. yd. \$11,660.48
37.63 sq. yds. 6-in. concrete foundation,
at \$0.60 per sq. yd. 22.57

Rock Asphalt:

2,227.38 sq. yds. resurfacing, at \$1.44
per sq. yd. 3,279.43
Inspection and minor unclassified repairs..... 385.31

Total..... \$15,347.79

The first asphalt pavement was laid in 1885. The guarantee expired in 1890. This pavement came under the care of the city in 1891. The length, area and cost of repairs of asphalt pavements on which the guarantee had expired was in:

Year.	Miles.	Sq. Yds.	Cost of Repairs.	Cost per Sq. Yd.
1891	0.447	9,482	\$0.00	0.00 cents.
1892	1.076	19,870	0.00	0.00
1893	2.400	43,670	0.00	0.00
1894	2.740	48,804	0.00	0.00
1895	3.413	60,329	76.62	0.12
1896	7.299	126,543	539.06	0.43
1897	10.428	171,950	7,186.56	4.21
1898	16.212	252,954	4,895.33	*1.87
1899	18.685	301,596	5,057.34	†1.67

1900	21.505	357,133	7,517.59	\$2.11
1901	23.744	391,956	12,396.81	\$3.17
1902	25.917	426,926	20,134.25	\$4.72
1903	26.499	434,079	15,347.79	\$3.58

* Excluding rock asphalt pavements—2.20 cents.

† Excluding rock asphalt pavements—2.34 cents.

‡ Rock asphalt repairs included.

The total amount of sheet asphalt pavements on which the guarantees expired previously to Jan. 1, 1904, was 26,446 miles, or 434,079 square yards. This amount is made up of—

Trinidad Lake asphalt, square yards.....	221,278
Rock asphalt, square yards.....	99,432
Vulcanite asphalt, square yards.....	113,369

Total, square yards..... 434,079

Of this amount, 6,417 square yards is within that portion of the street which the Rochester Railway Company is required to keep in repair; leaving a balance of 427,662 square yards to be kept in repair at the expense of the city.

The average cost for the year 1903 was \$0.0353 per square yard. The cost per square yard for each year that the pavement has been maintained is shown in the appended tables. The first general repairs to asphalt pavements were made in 1897. A comparison of the prices paid for repairs from that time to the present year is as follows:

Year.	Resurfacing including concrete, foundation, per sq. yard.	Resurfacing only, per sq. yard.	Skimming per sq. yard.
1897	\$2.25	\$1.75	\$1.60
1898	2.50	1.60	1.40
1899	2.10	1.35	1.25
	2.36	1.57	Rock asphalt.
1900	2.40	1.65	Trinidad Lake asphalt.
	2.36	2.52	Rock asphalt.
1901	2.50	1.65	Trinidad Lake asphalt.
	2.2559" concrete	1.63	Rock asphalt.
1902	2.50	1.65	Trinidad Lake asphalt.
	2.29	1.44	Rock asphalt.
1903	1.88	1.28	Trinidad Lake asphalt.

All asphalt pavements laid by the city since the year 1897 have been laid under a ten-year guarantee, excepting Glenwood avenue, which is guaranteed for 15 years.

THE ACETYLENE LIGHTING IN FRANCE

Early History of the Industry—Favor of the Public—Types of Apparatus Used—Municipal Lighting

*By Pierre Rosemberg**

It was in 1896 that the acetylene industry began its real expansion in France, and the installations multiplied. The very few constructors who, before that period, had taken out patents for their apparatus had in reality more trials than trade. There were many problems to be solved before the possibility of practical utilization of this brilliant gas; such as the generators, the fitting, the heating and the distribution, etc., etc.; and we must add that the government, the railroads, the insurance companies, were as yet so many enemies to the young industry. It was very popular with the public, at least until the explosion of liquefied acetylene in the works of M. Pectet in Paris, which dates the beginning of ill-will and the campaign of slander undertaken by the gas and other companies.

The enthusiasm of the pioneers of the new gas and their large number served in a great measure to arrest the feeling of public distrust. Evidence of this enthusiasm and vitality is found in the fact that 2,346 patents were taken out between 1895 and 1902.

At first the apparatus for water to carbide was the most numerous. The apparatus for carbide to water, which is mostly used now, made its appearance a little later.

In 1897, or perhaps a little later on, the principal insurance companies made a decision, still in force, which facilitates the installation of acetylene, and it was about the end of that year that the burners with connected rays and air draught made their first appearance.

In 1898 we saw the first installation of town lighting plants.

From the year 1900 there is noted a rapid increase in heating; one house alone sold more than 6,000 furnaces of various kinds.

In 1901 the development of the industry was marked with an important occurrence: Up to that time the lighting of the inside of the Paris Exposition was all that was permitted; the generation of the gas inside of the building was strictly prohibited. It was therefore a great event to see at the Agricultural Exhibition, a large alley in Champ de Mars, in Paris, lighted with 300 burners, furnished with a generator on the place.

TYPES OF APPARATUS USED

Automatic apparatus is most exclusively used in private installations, except by a few people who had put in the non-automatic types adapted to lighting localities.

According to an inquiry made the apparatus using carbide to water, and the apparatus based on the immersion or contact system, are about equally used. The apparatus for water to carbide are not quite so numerous, and the non-automatic machinery is scarcely five per cent. of the total number.

FAVORABLE ATTITUDE OF THE AUTHORITIES

Accidents are very rare, notwithstanding the large numbers of generators. The department of the Classified Establishments, in the police office, in Paris, expresses itself about the generators in this way: "The preparation of acetylene is not dangerous, if some precautions are taken. It is absolutely necessary to have generators powerful enough to insure the lighting during all its duration, but one must charge them during the daytime."

The accidents have largely been the results of carelessness on the part of those who refuse to observe the rules prescribed: insisting upon recharging their apparatus during the night and using candles, lamps, etc., about the generators.

The construction of automobile lamps has made a tremendous increase. There are at least ten houses in France manufacturing exclusively these kind of lamps and doing an immense business.

BURNERS

After the trial of different burners the cockspur burners with conjugated rays and air draught were finally adopted on account of their many practical qualities. Yet, after a communication from M. Javal, in which he made public the result of his studies, different manufacturers deliver excellent conjugated burners, without air draught.

INCANDESCENT

This process is as yet very little used, but it is mostly due to the fragile character of the mantles and because until recently the purifying of acetylene existed only in theory.

Different houses manufacture excellent incandescent burners but their use is far from becoming as popular in France as they are abroad.

We can not pass without stating that the trials of incandescence are no longer made with mantles but with agglomerates of a composition similar to that of the mantles, but much tougher. If these trials give the results which they promise, it will be a great step toward the solution of lighting, where shaking makes the use of mantles absolutely impossible.

INSTALLATIONS

There are in France 35,000 to 40,000 existing installations. In addition to 112 towns there are not less than 5,000 installations of more than 100 burners. Among these installations Vittel, an important watering place, possesses 2,000 burners. Important schools, convents, industrial establishments, castles, etc., also possess installations of 200 to 600 burners. There are also a great many private installations.

INSURANCE.—Any person wanting acetylene light on his premises must, if he is insured against fire, immediately notify the insurance company and have his policy changed accordingly. The companies, after having for a long time

* Honorary Secretary French Union of Acetylinists, Paris, France, who read this paper before the seventh annual meeting of the International Acetylene Association, held at St. Louis, Sept. 14-16, 1904.—[EDITOR.]

refused to admit that acetylene was not more dangerous than common gas, have at last been obliged to surrender. To-day there are very few companies opposed to acetylene.

MUNICIPAL LIGHTING

The lighting by municipalities is in general treated in two ways:

The municipality concedes the privilege of furnishing the public and private lighting to one person or to a company for a certain number of years. That person or company must build works, make the distribution, furnish the generators, establish the branch piping connecting the main distribution with the private houses, and in a word, to do everything necessary for establishing and furnishing the light. The municipality engages itself to pay a certain tax for its public lighting, and the gas is furnished at a special rate fixed beforehand. The municipality gives the privilege of making private installation and of selling them the gas at a stipulated price, and according to established

policies. After a certain time the whole material becomes the property of the municipality.

2d.—The municipality wants to be the owner of its lighting. One person or one company is asked to build the works, establish the distribution, furnish the apparatus and the municipality buys everything at a price stipulated beforehand, and takes care of it, selling the gas to private parties.

In closing we must say a few words about a system of lighting streets which has been tried in many places without giving exactly satisfactory results. Some towns do not possess the necessary capital for the establishing of distribution. Other towns provided with coal gas mains wish to try acetylene gas in some street not provided with mains. In these different cases automatic lamps are provided.

There are many inconveniences to this system: The recharging, cleaning and the portable apparatus which, as we know, needs perfecting. However, all these impediments are overcome through careful installation.

WATER WASTE AT MARION, OHIO

Its Detection and Prevention—The Installation of Meters and Their Protection Against Freezing—The Flat Rate System Inequitable

*By Edward H. Cowan**



EDW. H. COWAN
Superintendent

MARION is a rapidly growing little city, with a population, in 1890, of 8,327; in 1900, 11,862, and at the present time (1904), about 15,000. It is situated on the divide between the Mississippi and the St. Lawrence rivers, only a few miles from the line separating those two great watersheds. The city water supply is obtained partly from an impounding reservoir excavated through a stratum of clay into a water-bearing gravel; and partly from a series of ten 10-inch drilled wells, from 100 to 200 feet deep, reaching into the limestone formation which underlies the country around.

During the lawn sprinkling season of 1900, it was with the greatest difficulty that enough water could be obtained to supply the city. The water in the wells was so far below the level of the pumps, as they were then located, that only a small amount could be drawn from that source. The average daily consumption for the year 1900 was 825,692 gallons, or 1,290 per tap. It was considered that this was excessive, and from that time on greater attention has been given to the detection and prevention of waste. It is the purpose of this paper to describe some of the methods used and the results obtained.

It was thought that the greater part of the leakage was on the customers' side of the curb cocks, and the subsequent events have shown that this view was correct. The installation of meters was decided upon, and has been going

on ever since. The water works plant is owned by a private company, and under the terms of its franchise a customer has his choice whether he will pay fixture or meter rates, in the latter case furnishing and maintaining his own meter. It is thus impossible to place a customer on a meter basis against his will, unless he be found wasting water, in which case the franchise provides that he may be required to buy a meter and pay meter rates, or his water may be shut off.

The policy adopted was, therefore, that the Water Company should place a meter on the service pipe of each fixture-rate customer who should continue paying the same rate as before, so long as the meter showed him not to be wasting water. A monthly allowance is made for each individual customer and if he uses more than this amount a postal card notice is sent him, to the effect that his meter indicates a large waste of water, which must be stopped.

If at the end of the next month he is still using more than his allowance, the same notice is sent again, with the words "Second Notice" stamped across the face. At the end of the third month the following is stamped on the postal card: "Last Notice.—We have already sent you several notices to this effect. If the amount used next month indicates a waste of water, you will be required to buy the meter and pay by the thousand gallons." At the end of the fourth month he is required to buy the meter as above, and pay the original cost of setting it.

The monthly allowance for any customer is obtained by dividing his monthly fixture rate by the regular meter rate per thousand gallons. If a customer should consume exactly his allowance each month, he would be obtaining water

* Superintendent Marion City Water Company. Paper read before New England Water Works Association and first published in its Proceedings. Republished by permission.—[Editor.]

practically at meter rates, yet with the water company furnishing the meter, instead of the customer. The margin between what he does use and what he is allowed to use may be said to reimburse the water company for setting and maintaining the meter.

Before adopting a plan of this kind a water works company should carefully determine if its meter and fixture rates bear proper relations to one another. The rates should be such that the company would not suffer if fixture rates were abolished, and all the customers paid by meter, taking into account the lesser amount of water required in such case. In this city we were influenced by the probability that we should be put to great expense increasing our water supply unless waste could be largely reduced.

We have very little friction with our customers in carrying out this plan, as its fairness can be easily shown to almost any one. We have found a few new customers who seemed to be legitimately using more than their allowance, while many others were not using one-tenth of theirs, which goes to show how inequitable a fixture or flat rate system is.

Meters have been placed in school and city buildings and churches, all of which are supplied with water free, and especially in the school buildings have the meters paid for themselves many times over in restricting waste.

Whenever possible, meters are placed in cellars. In some cellars it has been found necessary to protect the meter from freezing. This has been done by building a rough wooden box around it, enclosing all the pipe back of the meter and inside the cellar wall, and as much of the pipe ahead of the meter as practicable. The top of the box is left open and it is filled with saw-dust, which can be brushed away when the meter is read.

Even with such protection it is found that occasionally a meter will be frozen, on account of the water in the pipe outside of the box freezing, and the ice gradually extending back to the meter. The cost of the labor and material for taking out, repairing, and resetting a meter averages about \$1.00.

In a building which has no cellar the meter is, if possible, set under the floor at the point where the service pipe enters the premises. A wooden box filled with saw-dust, as above described, is usually required, and a trap door is made in the floor to provide access. It is seldom that a meter set in this manner freezes.

When yard hydrants or other outside fixtures are in use, or when for any other reason it is impossible to set the meter in either of the places mentioned above, it is set in a meter box out of doors. The box now used for this purpose was invented and patented recently by Mr. B. C. Palmer, street foreman for the water company, and the writer. It is made of iron, and is cast in two halves for convenience in molding. The halves are fastened together at diagonally opposite corners by bolts. The cover is held on by a bar attached to the pentagonal-headed bolt which passes through the cover. The bar engages two wedges inclined in opposite directions, so that a quarter turn of the bolt will fasten or unfasten the cover. A second cover of wood rests on a flange cast on the inside of the box about twelve inches below the top. The air space

between the two covers has never yet failed to keep the meter from freezing.

The meter inspector, on his monthly rounds, listens at every tap where it is possible to do so, and reports any case where there seems to be a leak back of the meter. To do this requires some time, but it is time well spent, as one or more leaks are found every month.

Since January, 1902, all taps have been laid with lead pipe by the Water Company's own men, including worn-out ones. Previous to that time galvanized iron (or steel) was used, and many of the older ones are giving out.

Nearly all the soil in this vicinity is impervious to water, and leaks are not long in showing at the surface, unless, as occasionally happens, they be close to some drain which furnishes an outlet to the water. In considering the large amount of water pumped in 1900, it was thought that this might not be the case and that there might be many leaks not appearing at the surface. Consequently it was decided to make a complete survey of the entire system to determine if this were true.

The apparatus used consisted of a horse and wagon, a 1½-inch Gem meter, 9 fifty-foot lengths of 2½-inch hose, gate keys, curb cock wrenches, and lanterns. The writer took personal charge of the work and was assisted by two men, one of whom was an old employee, familiar with the system. The work was done between the hours of 10 P. M. and 5 A. M., but in larger cities it would not be best to start so early.

After two or three nights it was found necessary to follow out in detail the original plan, but that certain modifications might be made which would greatly facilitate the work without making it any less thorough. The original plan of operations will first be described, and afterward the ways in which it was modified.

Two gates were closed, thus cutting out the section to be tested. This section will be referred to as a "block," although in some of the older parts of the town, gates are as many as three or four blocks apart. A line of hose was laid from the nearest "live" fire hydrant to a "dead" one, and the meter placed in the line next to the "dead" hydrant. Both hydrants were then opened, and if the meter showed water to be passing into the "dead" block, its rate of flow was noted, and one of the men started to close the curb cocks in that section.

Careful watch was kept at the meter, and if after closing any curb cock the rate of flow diminished suddenly, or ceased entirely, it was concluded that either there was a leak on that service, or the customer was using water, and an investigation was made to determine which was the case. Whenever the flow ceased entirely, the investigation of that section was at an end. After closing all the curb cocks, if water was still running through the meter, one or more leaks were shown to be in the "dead" block, and they were located in every case by listening at the curb cocks.

The work went on in this manner, block after block, for several nights, resulting in the finding of only two or three leaks. The writer then concluded to try four or five blocks at once. In this case quite a number of gates had to be closed, and most of them were attended to in the day-time,

leaving only as many to be closed in the night as were required for efficient fire service. At the first trial the meter stood still, so from that time on still larger sections of the town, containing from two to three miles of mains, were cut out and tested at once.

When a leak was found its rate of flow was noted, as before, and then the size of the "dead" section was reduced one block at a time by opening and closing proper gates, working towards the meter. In this manner the block or blocks on which there were leaks were located.

After the first few nights the shutting off of curb cocks was discontinued, as very few leaks were being found, and those could be easily located in the stillness of the night by placing the ear against one end of the street key, holding the other end on the curb cock. In the down town sections of larger cities, however, where there is more or less noise from teams all night, it might be best to shut off the curb cocks.

When testing two or three miles of mains at once, a simple system of lantern signals was used between the man at the meter and the men who were opening and closing gates. Sometimes these latter were nearly a mile away from the meter, and without signals much time would have been consumed going back to it after cutting in each new block. The 1½ inch Gem meter was used, not because it is the best size or kind of meter for the purpose, but because it happened to be available. It has hose couplings, and is in regular use for measuring water taken from fire hydrants for miscellaneous purposes. Were the writer to do this work over again he would use a smaller meter of the piston or rotary type.

The method of finding leaks in the street mains and services above described proved perfectly successful, as well as economical. It is thought that no leak escaped detection. The failure of a gate to close tightly was considered, but the effect of such a case would have been only a somewhat reduced rate of flow through the hose and meter. Tests for unauthorized connections might be made in a similar manner in the day time, first closing all known curb cocks. By taking one block at a time, patrons need be deprived of water for only a short period.

The effect of the above and other less important methods of discovering and restricting waste is shown by the following statement: The average number of taps in use in 1900 was 640, of which 32 per cent. were metered; in 1903, an average of 891 taps were in use, 72 per cent. of which were metered.

Estimated portion due to installation of meters,	Gallons.
Average amount of water pumped daily per tap in 1900	1,290
Average amount of water pumped daily per tap in 1903	648
Difference	642
Decrease due to loss of five large customers....	272
Decrease due to restriction of waste.....	370
Estimated portion due to installation of meters, 0.8 of 370.....	296
Total annual saving due to installation of meters, 296 x 365 x 891.....	96,263,640

This may be regarded as a fairly close estimate of the amount of water which would have been pumped in 1903 in addition to what was actually pumped, had there been no meters placed on other than the usual proportion of new services, whose owners prefer to buy meters and pay meter rates. This saving has been brought about by the installation of 240 company meters, each meter thus being credited with 401,098 gallons.

In order to make sure that this amount is not over-estimated, we will divide it by two, which gives, say, 200,000 gallons annual saving per meter. The cost of the fuel and lubricating oil required for pumping 1,000 gallons is \$0.0094, or \$1.88 for 200,000 gallons. Deduct 17 cents, which is the annual cost of reading the meter, and 13 cents, the cost of maintenance, leaves \$1.58, which, at 6 per cent., represents the annual interest on \$26.33. This is a little less than double the cost of setting the average meter.

As stated above, enough meters have been set to increase the number of metered services from 32 to 72 per cent. of the total. It should be understood that meters have now been placed on all taps where there was especial likelihood that water was being wasted, such as saloons, livery stables and stores, and that the remaining 28 per cent. represent mainly small customers having but one faucet or one yard hydrant.

It will be seen that the meters which have been set by the water company have paid for themselves nearly twice over, in saving of fuel and lubricating oil alone. In addition, the expenditure of large sums for increasing the available water supply has been postponed at least five years and probably more, as a direct result, not to mention lesser savings, such as wear and tear of machinery and boilers.

LAW FOR REMOVAL OF ICE AND SNOW

IN a test case the court has recently decided that the law passed by Congress compelling the removal of snow and ice from the sidewalks by the owners or occupants of the premises, is null and void.

The main point in the opinion is that the law is unequal in that it imposes penalties on the private citizen while there is no law to compel the commissioners to act in the case of

public buildings and grounds, or to compel the commissioners to act in case of delinquent owners or occupants. The court asserts that the primary requisite of all such legislation is that it should be equal and capable of universal enforcement, and because of inequality it is void.

This decision leaves the commissioners with 500 miles of sidewalks to clean and no appropriation for the work.

PORTLAND CEMENT*

Its Uses in Engineering Constructions—Analyses of Ancient Mortars—Uniformity of Hardening.—Continued

By E. Kuichling, C. E.†

IN the preceding number of the MUNICIPAL JOURNAL AND ENGINEER, reference was made to the constitution of ancient lime mortars as indicated by chemical analysis. Several such analyses made by various chemists are accordingly given in the following table. A few important practical points connected with the setting and hardening of cement mortars will then be considered.

ANALYSES OF ANCIENT LIME MORTARS.

In the foregoing, reference was made to the setting and hardening processes of common lime mortars, and to the question whether the lime eventually combines chemically with the inert silica of the sand. On this latter subject, the opinions of chemists differ, some contending in favor of such a combination, while others are in strong opposition. As was seen above (pp. 151 and 251), Petzholt and Tomëi are positive that in the course of time the inert silica will be attacked by the lime, and Michaelis (p. 211) admits that this seems to occur under high pressure and at a temperature of only 100° C.

It is also stated by Simonet, in his treatise on "Maçonneries," Bibliotheque du Conducteur de Travaux Publics, Paris, 1897, that "in some foundations laid several centuries ago, the fat lime mortar is as hard as if it had been made of hydraulic lime; and in most of these cases it has been found that some of the silica of the sand has combined with the lime." Gillmore likewise asserts that the hardening of fat lime mortars cannot be entirely attributed to the formation of carbonate, as it is known that "mortar in the center of thick walls, which never becomes carbonated, nevertheless possesses a fair degree of adhesiveness and hardness * * * whence there must have been a chemical combination between the lime and the silicious sand."

In opposition to this theory, it is urged by other authorities that if any calcic silicate is found in ancient mortars, the silica must have been contained in the limestone before its calcination, as it is a well-known fact that most varieties of such stone contain varying quantities of silica, and that during calcination this substance combines with some of the lime to form a natural cement, to which the durability of the ancient mortars is mainly due. Thus, in an extensive examination of old mortars obtained from various ancient English castles and abbeys in 1892, it was found by John Hughes that certain British limes contain from 9 to 15 per cent. of silica, which becomes active or gelatinous on hydration, while the best Portland cement contains from 20 to 22 per cent.; also that some of the best and most durable of these old mortars contained from 4 to 5 per cent. of ferric oxide and alumina, while the amount of caustic lime therein did not exceed 0.5 per cent. on the average. He therefore concluded that neither the percentage of free lime

nor that of total lime, in an old mortar was a reliable criterion of its quality.

In view of these conflicting theories, the following analyses of ancient lime mortars are of interest:

TABLE SHOWING CHEMICAL COMPOSITION OF A VARIETY OF ANCIENT LIME MORTARS.

No.	Age, Years.	CaO.	CO ₂	Soluble				Sand,				Total
				SiO ₂	Al ₂ O ₃	Al ₂ O ₃	Fe ₂ O ₃	MgO	H ₂ O	etc.		
				and Fe ₂ O ₃								
1	600	8.70	5.00	1.25	—	—	—	—	1.30	83.75	100.00	
2	"	9.25	1.75	3.75	—	—	—	—	6.75	78.50	100.00	
3	1800	15.16	9.00	0.27	2.75	—	—	—	4.00	68.00	99.18	
4	"	24.00	12.00	0.25	2.75	—	—	—	5.00	56.00	100.00	
5	"	6.90	2.25	0.35	—	—	—	—	1.00	89.50	100.00	
6	"	29.10	20.00	—	—	—	—	—	5.90	45.00	100.00	
7	200	27.50	20.00	—	—	—	—	—	1.90	50.00	99.40	
8	120	26.60	19.20	—	—	—	—	—	3.60	51.50	100.00	
9	3500	31.80	4.48	5.30	—	2.41	0.25	0.28	17.10	*37.90	99.52	
10	"	32.39	4.72	4.30	—	3.00	0.21	0.38	17.40	*38.60	101.00	
11	—	26.40	20.23	—	—	2.16	0.99	0.97	0.54	†48.97	100.26	
12	—	51.58	40.60	—	—	0.40	—	0.70	3.09	‡2.02	98.39	
13	—	45.70	37.00	—	—	2.64	0.92	1.00	0.36	12.06	99.68	
14	—	49.65	38.33	—	—	0.98	0.82	1.09	3.07	‡4.94	98.88	
15	—	15.30	11.80	—	—	14.70	4.92	0.30	5.20	†46.51	98.73	
16	—	29.88	23.80	—	—	2.86	2.32	0.25	1.00	†41.75	101.86	
17	—	19.71	13.61	—	—	16.39	1.23	0.71	8.20	36.26	96.11	
18	—	25.19	17.97	—	—	10.64	3.67	0.90	5.50	32.72	96.52	
19	1500	14.50	11.29	0.40	—	—	—	0.04	0.92	†72.88	100.00	

*Consists wholly of sulphuric acid (SO₃).

†Includes 0.21 parts of SO₃.

‡ " 0.82 " " "

§ " 1.04 " " "

|| " 5.41 " " alkalis and organic matter.

†† " 8.39 " " " " " "

‡‡ " 18.18 " " brick, clay, alkali, etc.

The mortars mentioned in the foregoing table were taken from the following named structures: No. 1, Cathedral of Brandenburg; No. 2, damp foundation walls of church of St. Peter, in Berlin; Nos. 3, 4 and 5, Roman wall and tower at Cologne; No. 6, Roman tower at Bologna; Nos. 7 and 8, tombs at Hyderabad and Masulipatam; Nos. 9 and 10, exterior and interior of the Pyramid of Cheops, Egypt; Nos. 11 and 12, ruins of a buried Phœnician temple near Larnaca, Cyprus, No. 12 being a white cement used for joining tile drain pipes found ten feet below the surface; No. 13, a part of the Pnyx, Athens; No. 14, temple at Pentelicus, near Athens; No. 15, Adrian's villa at Tivoli; No. 16, interior surface of a hall in Herculaneum; No. 17, roof of the old Latin Tombs near Rome; No. 18, mosaic floor of the Baths of Caracalla, Rome; No. 19, Roman ruins near Yarmouth, England.

The analyses of Nos. 1-5, inclusive, were made about 1818, by Dr. John, of Berlin; those of Nos. 6-8 are given along with the preceding in Vicat's treatise of 1828; those of Nos. 9-18 were made about 1865 by Dr. William Wallace, of Edinburgh, and are given in Vol. 11 of *London Chemical News*; and that of No. 19 was made by J. Spiller, and is taken from the *Transactions of the British Association for the Advancement of Science*, 1865. The entire series is also given in Reid's "Practical Treatise on Concrete," London, 1869. It will be noticed that they were all made many

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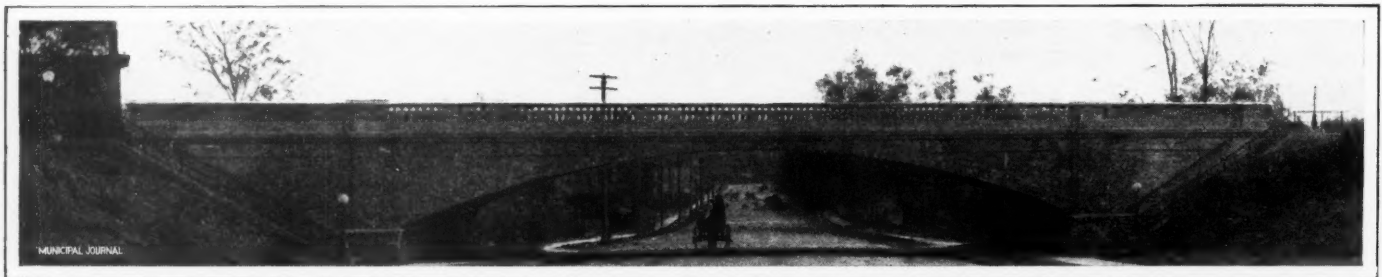
† Engineering Editor, MUNICIPAL JOURNAL AND ENGINEER.

years ago, and probably somewhat different results would be reached if the methods of analysis now in use were applied. The figures must, therefore, be regarded only as approximations, and the conclusions that have been drawn therefrom by various writers are consequently open to debate.

Referring to the above analyses, Reid remarks that in some cases the process of carbonating appears to be well advanced, while in others it is far from completion. Carbonic acid may therefore be an important agent in the hardening process of common lime mortars, but it is not so in the case of hydraulic limes and cements, as these substances are capable of attaining their maximum hardness without such aid. In their investigations of ancient mortars, Messrs. Wallace and Spiller found very little soluble or active silica, and hence concluded that their hardening was due essentially to the absorption of carbonic acid. In illustration of this theory, it may be mentioned that the quantities of carbonic acid in the several analyses are not sufficient to produce perfectly formed or saturated calcium carbonate (CaO , CO_2) and that in comparison with the amount necessary for saturation, the said quanti-

memoir of 1818, that on demolishing one of the masonry columns of a church tower, which had been built for more than eighty years and was about twenty-seven feet in diameter, the mortar in the interior was found to be as fresh as if it had been applied only the day before, and that the lime was still caustic and readily formed a cream with water. It is also stated in Muspratt's "Chemistry as Applied to Art and Manufactures," p. 456, that "it has been proved experimentally that the mortar in the interior parts of a massive structure contains no carbonate of lime after 300 years and longer, and that what has remained without otherwise entering into combination with the material of the stone or brick, is still caustic; and that at most only one-half an equivalent of carbonic acid is absorbed, producing a basic or sub-carbonate of lime."

In like manner, Simonet states in his treatise on Masonry, Paris, 1897, that the hardening of common lime mortar is due primarily to the dessication of the hydrate of lime, and secondarily to the absorption of carbonic acid from the air, which transforms the hydrate into carbonate of lime. This absorption, however, proceeds very slowly from the surface to the interior of the mass, and it has been observed in



SEELEY STREET BRIDGE, BROOKLYN, N. Y.—SPAN, 85 FEET; WIDTH, 54 FEET; CONCRETE CONSTRUCTION RE-INFORCED BY STEEL BARS—ALPHA PORTLAND CEMENT USED

ties are represented by the following percentages:—73.0 in No. 1; 24.3 in No. 2; 75.0 in No. 3; 63.5 in No. 4; 42.0 in No. 5; 87.4 in No. 6; 93.2 in No. 7; 83.2 in No. 8; and similarly for the remainder.

In Nos. 9 and 10, relating to the Pyramid of Cheops, the mortar does not appear to contain any sand, and the silica is evidently in combination with the alumina as clay; but it contains respectively 81.50 and 82.89 per cent. hydrated sulphate of lime, thus indicating that the value of this substance as a binding material, in a climate free from frost, was known to the ancient Egyptians. It is also supposed by antiquarians that mud from the Nile was used by them in combination with calcined gypsum in preparing mortar. No. 11 is probably the oldest mortar in existence; it is extremely hard and contains sharp sand and pebbles, some of the latter being 0.5 inch in diameter. No. 13 is of interest, being derived from a part of the platform from which Demosthenes delivered his orations, and also exhibiting a sufficient quantity of carbonic acid to fully carbonate the lime and magnesia.

UNIFORMITY OF THE SETTING AND HARDENING PROCESS

In the case of common lime mortars, it is known that the process of hardening takes place progressively from the exterior of the mass to the interior, and that carbonic acid penetrates into it very slowly. Thus Dr. John states in his

several cases that the mortar in the interior portions of very thick walls was still soft, even after the lapse of two centuries. In general, the drying of such masses of masonry should proceed slowly, as otherwise the lime will shrink in volume and thus lead to the disintegration of the mortar, before the crystallization due to the absorption of carbonic acid has been established; hence lime mortar is usually found to be stronger in damp places, like foundations, than in the portions of the structure which are above ground and where dessication proceeds too rapidly.

On the other hand, in the case of hydraulic limes and cements, it seems to be tacitly accepted by most writers on the subject that induration proceeds *uniformly* throughout the entire mass. This important matter, however, has not received the attention it deserves, and appears to be rather an assumption based on superficial examinations of large masses of mortar or cement, than a demonstration founded on careful physical investigations of such masses. Among the few authors who refer to this point explicitly we may cite Gillmore, who states on p. 34 of his treatise on "Limes, Hydraulic Cements and Mortars," New York, 1874:—

"It is well known that hydraulic mixtures owe very little of their powers of sub-aqueous induration to the absorption of carbonic acid, or to superficial dessication; that the setting is not initiated at the surface, but almost simultaneous-

ly throughout the mass; and that the subsequent induration is not augmented, but rather retarded, and in some measure even destroyed, by free contact with the air, and the absence of humidity. We may safely assume that mortars of hydraulic cement, either with or without sand, if submerged, harden so nearly homogeneously throughout their entire thickness, that there is no perceptible difference in hardness at the center and at a depth of $1/10$ to $1/8$ of an inch."

In a long discussion on Portland cement by numerous experts before the British Institution of Civil Engineers in 1892, contained in Vol. 107 of Proc. Inst. C. E., it was vaguely suggested by one speaker that cement mortar sets first on the outside of the mass, thus forming a protective skin. This intimation, however, was denied emphatically by Mr. Faija, who was then regarded as one of the foremost English authorities on the subject. In his opinion, the setting was a purely chemical action, caused by the permanent combination of water with the anhydrous substance of the cement, thereby forming new solid compounds containing fixed water of crystallization. If the setting began at the surface, the protective skin would prevent the escape of any surplus water used in mixing the mortar, and the interior of the mass would remain soft indefinitely; but as this is not the fact, it follows that the cement and mortar must set evenly or uniformly throughout its entire bulk. No further reference to the matter under consideration was made in the discussion.

This brief argument is far from being satisfactory, as it does not explain how any excess water in the mixture finally escapes from the interior of the mass without the formation of either cavities holding such water or small passages to the exterior. If the mortar is rich enough in cement, it is generally recognized that the mass will become dense and practically impervious, especially when water in considerable excess is used in mixing, and hence it is of interest to establish a sound theory for the escape of the surplus. It is also known that some cements will absorb very small quantities of water in twenty-four hours, while the setting is completed within one or two hours. Thus it is stated in *Thonindustrie Zeitung* for 1895, p. 597, that Prüssing tested eleven different Portland cements and found that on being gauged with about 20 per cent. of water, none of them absorbed more than 2.5 per cent. of water in twenty-four hours, and that some absorbed only 1.5 per cent.; furthermore, that subsequent examinations indicated that cements which absorbed from 2.5 to 3.0 per cent. of water in one day were generally unsound.

By adopting Le Chatelier's theory of crystallization from super-saturated solutions, and then assuming that solidification begins in the middle and proceeds more or less rapidly to the surface of the mass, the manner in which the surplus water escapes can easily be explained. On this theory the liquid in the outer layers will be kept from becoming super-saturated by the water rejected from the interior, until the surplus has escaped either directly or by evaporation or absorption; and plausibility is given thereto by the fact that when a mass of wet cement or mortar begins to set in the air, a film of apparently clear water always exudes on the surface, and then gradually disappears. The heavier or super-saturated liquid thus continually dis-

places by gravity the lighter solutions, and forces them out upward or laterally by the paths of least resistance through the soft exterior mass, until the whole has become solidified.

While this simple theory appears to be supported by observations of small masses of cement or mortar, it does not always conform to the behavior of large masses of concrete, which were made rapidly without allowing sufficient time for one layer to set before the next one was deposited. In certain cases of the latter kind which came under the writer's notice, the induration appeared to be more energetic at the surface than in the interior, and this was particularly noticeable in the case of natural cements. By drilling deeply into such masses a few weeks after their formation, the mortar was found to be considerably softer in the interior than at the surface; but as it was impracticable to make at the time any quantitative determinations of strength or hardness, no figures are available.

Similar experiences have also been recorded by others, and among them the following three may be cited. The first is by William J. McAlpine, C. E., in connection with the concrete filling of the tubular iron piers of the former bridge over the Harlem river in the city of New York, and described in 1873 in *Trans. Am. Soc. C. E.*, Vol. 2, p. 425. Here the concrete was deposited in a mass from 5 to 6 feet deep at the bottom of iron cylinders filled with compressed air at more than 20 pounds pressure, and was soon penetrated by the water which entered from the soil below. On subsequent examination it was found that a crust, broken in some places, had formed on the top of the concrete, thus preventing the compressed air from permeating the mass and excluding the water.

The second is by J. A. Monroe, C. E., in connection with the removal of certain bridge piers, about 25 feet high, near Kingston, N. Y., and described in 1884 in *Trans. Am. Soc. C. E.*, Vol. 13, p. 65. These piers had been built about one year previously, and were of first-class stone masonry laid in cement mortar, the joints of the backing stones being rather thick. The cement used in the work was made by the Hudson River Co., and had been found entirely satisfactory elsewhere. On taking down the masonry, it was found that the mortar in the interior had not set, and could be shoveled out like damp loam. After its removal, however, it soon hardened, and experiments showed that an exposure of one-half hour to the air sufficed to make it set as hard as could be expected of the best cement mortar.

The third is by Thomas Potter, C. E., on p. 161 of his treatise on "Concrete and its Use in Building," London, 1894. This author states that he "once had to remove a piece of Portland cement concrete wall, 4 feet thick, which had been deposited in place several weeks and formed a portion of the foundation of a church tower; the center of the mass might have been pulled asunder with slight exertion, and as the concrete approached the outside of the wall it increased in hardness." He also states that when concrete foundations have been completed, the upper portion hardens rapidly, whence it might be inferred that the mass can sustain a considerable weight "within a day or two; but this is not so, as the atmosphere is an important factor in hardening concrete, and in proportion as it can act on the latter, so is the setting hastened or retarded. The better

the concrete, so far as homogeneity is concerned, the more difficult is it for the air to permeate, and in the case of foundations, where the bottom and sides of the concrete are encased with the surrounding soil, the obstruction is still greater; but there can be no doubt that the hardness of the mass is ultimately increased by this retardation."

In opposition to these experiences with large masses of cement concrete and mortar, in which the interior was softer than the exterior portions, the following three different observations will be of interest. In a paper before the American Society of Civil Engineers, read in 1872 by Maj. A. F. Sears, U. S. A., (*Trans. Am. Soc. C. E.*, Vol. 2, p. 12), it is stated that "the parapets on the bastion of Fort Clinch, Fla., were filled with concrete made of the Hudson River Company's cement. After standing a year, they were removed to adapt the works to new ordnance, and so thoroughly were they indurated that it became necessary to use drill and blast to accomplish the purpose. Such masonry preserved for a year in caissons from the action of water in submarine works, will be found equal to all requirements."

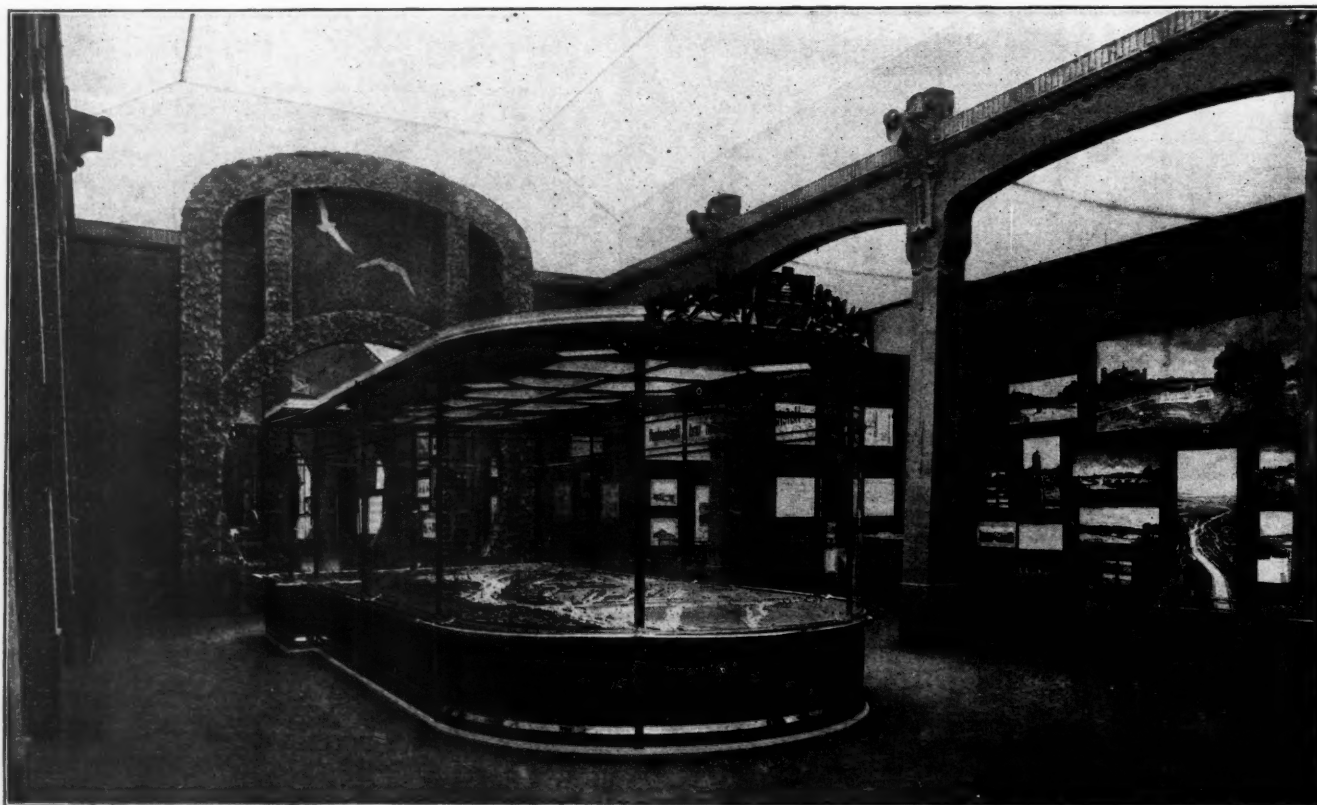
The second is by F. Collingwood, C. E., in *Trans. Am. Soc. C. E.*, Vol. 2, p. 424 (1873). Referring to the concrete used in filling the foundation caissons of the piers of the East River bridge, the author states that "the material set as well under air pressures of 35 and 15 pounds per square inch on the New York and Brooklyn sides respectively, as in the open atmosphere. When concrete is laid under pressure, the air will pass through it outward, or water through it inward; probably the first hastens the action of

setting, while the second, by separating the cement and sand, retards or prevents this action. After the fire in the Brooklyn caisson, it was necessary to remove several cubic yards of the concrete, and although none of it had been laid longer than four weeks, the portion taken out was quite hard. Wherever examined, it had set uniformly throughout the whole mass."

The third case was recently communicated to the writer by W. H. Coverdale, C. E., of New York, in relation to a massive concrete foundation, 60 feet long, 10 feet wide and 16 feet deep, which he had constructed some years ago for certain machinery in a large manufacturing establishment near Pittsburg, Pa. The concrete was made of Dyckerhoff Portland cement, sand dredged from the Allegheny river and local hard sandstone broken to pass through a 2.5-inch ring, the proportions being 1 volume of cement to 2 of sand and 4 of broken stone. A few days after its completion it became necessary to cut a trench 2.5 feet deep across this foundation for the purpose of laying a water pipe; and to the surprise of all who saw it, the material was found to be of the same great hardness along the entire bottom of the trench as at the surface.

While many other observations might be cited in support of different opinions concerning the induration of cement mortars and concrete, it is believed that the foregoing will suffice to show that the subject has hitherto not received the attention it deserves, and therefore it is hoped that experiments will soon be instituted which will throw more light on the question of the uniform hardening of Portland cement.

(To be continued)



PART OF EXHIBIT AT DRESDEN MUNICIPAL EXPOSITION—150 GERMAN CITIES REPRESENTED

Sewage Disposal Works

REPORTS from twenty stations maintained by English municipalities for the disposal of sewage have been compiled by Mr. T. Salkied, surveyor to the Urban District Council of Leatherhead, from answers received to inquiries made by him respecting the methods in use at the several plants, and placed in the accompanying comparative table, which will repay careful consideration.

It will be noted that there is a wide divergence of treatment in even so short a list, varying from broad irrigation plant, occupying thirty acres of land, to a series of bacteriological tanks requiring but three acres.

Four stations report no crops raised, and the products of the others are limited to the coarser grasses, grains and vegetables.

In the conduct of the works the surveyor acts as manager in about one-half of the instances given, and is assisted by a foreman, engineer and stokers and such laborers as the size and character of the plant require. In most cases a house is provided, rent free, for the manager, whose wages range from £20 per year to £2 10s. a week. The usual holidays are allowed the helpers, or there are alternate shifts among the force.

At the larger number of plants the process of disposal is by precipitation, filtration and land irrigation, and at Walton-on-Thames the smudge is run into drying beds and sold to the neighboring farmer.

A supplementary report stating the increase in yield in the several crops raised under the stimulus of this fertilizer would be of interest in determining its commercial value.

THE amount in tons, or some other standard, of the fertilizing product and its value from a city of a given population would also be of interest as establishing the normal income which should be derived from this source. And tests could be made to determine the most profitable form for its use, whether liquid to be used in irrigation, or dried to

be spread on the land, or in the form of ashes to be sown with the crop.

Sewage is at present a problem to most American cities, when it should be, and in the future will be an item of revenue in municipal finance, and, too, a source of profit to the suburban truck farmer.

Town.	Population	Rate-able value.	Method of treatment.	Is auto-matic gear used.	Area of land.	What crops are grown.	Is sewage pumped at works.	Is engineer in charge, also manager.	What assistance allowed.	Wages paid for such assistance.	Wages paid to manager.
BEEFOS ...	10,377	36,000	Broad irrigation	—	30	Mangolds, sweeds, rye, rye grass, cabbage, oats	Yes	The surveyor acts as manager	Two men and two or three boys in summer for weeding	Men 23s. per week; Boys 7s. per week	35s. per week
BROMSBOROUGH ...	12,000	—	Precipitation tanks (not chemical). Upward and downward filtration through coarse gravel and land irrigation	No	94	Mangolds, peas, beans, turnips, sweeds, cabbage	No	Yes, foreman kept	General labourers as required from time to time	3s. and 2s. 6d. per day	20s. per week
CLAYTON & MOORS GREAT HAWOOD ...	9,000 } 12,300 }	—	Land filtration; the storm water is passed through filters of clinker and ashes	No	25	Turnips, mangolds, cabbage, &c.	No	No .. .	The assistance varies with season of year	About £8 10s. per week	30s. per week
DONCASTER ...	10,000	40,000	Bacterial, by means of open septic tanks, first and second continuous flow filter beds, followed by land treatment on 10 acres	No	10	None at present ...	About one third is pumped	Yes, inspector of nuisances, resident manager at extra £30 per year and house	One man in charge of works and other labourers as required	18s. per week and house	£20 per year and house extra
DORKING ...	7,700	44,157	Precipitation, by chemicals with subsequent intermittent filtration. Double contact beds but no detritus tank	Yes	6	None now, formerly oysters and cabbage	No	The foreman under surveyor	Pressman, 26s. per week; tankman 20s.; two men on land and 15s.	—	40s. per week and house, &c.
EAST BARNET VALLEY ...	10,094 (1901)	66,535	Sewage put on to be land then collected in precipitating tanks and then put through bacteria filters	No	60	Rye grass, mangolds, cabbage, turnips, leaves	No	Yes .. .	Four men always and additional men when required	Regular men 25s. per week, extra men 24s. per week	£2 10s. per week
EASTLICH AND BROMSBOROUGH RURAL DISTRICT COUNCIL	10,750 estimated	57,836	Intermittent downward filtration through gravelly soil about 6 ft. deep	—	21	Mangolds, cabbage, beans, peas, grass	Yes, about 30 ft.	No, farm under separate foreman	Varies according to time of year	Two engine-drivers, 24s. per week, and one man 18s. per week	25s. per week
ESSEX RURAL DISTRICT COUNCIL	4,000	24,357	Contact beds and tank	No	6	Mangolds, potatoes	Yes	Yes .. .	When cropping, &c., what is necessary	19s. per week per man —	35s. per week
FARNHAM ...	12,083	54,000	Bacteria and land	Yes	26 and 8	Mangolds, turnips, wheat, oats, willows	No	Farm managers under surveyor	3s. to 3s. 6d. per day	27s. per week	27s. per week
LEATHERHEAD ...	7,000	28,461	Septic tank and double contact beds ..	No	9	Rye grass and mangolds	No	Manager under surveyor	One man with occasional extra help	21s. per week	25s. per week and house
MEDBOROUGH ...	11,600	35,294	Bacteriological tanks. Nine primary tanks, six 22 ft. 6 in. by 20 ft. by 8 ft. and three 40 ft. by 40 ft. by 3 ft., and six secondary tanks 70 ft. by 33 ft. by 3 ft.	No	3	Very little, area occupied by sludge	Yes	No .. .	Surveyor's men when required	3s. 8d. per day	25s. per week and house
OTLEY ...	10,000	42,000	Two small screening tanks. Five open septic tanks, capacity 500,000 gallons. Tank effluent turned on to land	—	16	Mangolds, cabbage, cauliflower, rye grass	No	Yes .. .	Varies according to season, one man constantly in addition to manager	24s. per week	24s. per week and house
ROBBERDEN ...	14,000	38,475	Chemical precipitation (through an "Ive's" tank) followed by land treatment on irrigation areas	—	22	Mangolds and rabi, brussels, carrots, celery, cabbage	No	Working foreman under surveyor	Three labourers ..	6d. per hour or 3s. 6d. per day	25s. per week
SHARNKESDALE ...	7,000	19,899	Land irrigation	No	12	Grass	No	Included in surveyor's salary	One man to clean out gutters on farm	18s. per week	—
SOUTHALL NORWOOD	18,500	73,680	Precipitation combined with first contact and land	No	21	Rye grass, mangolds and cabbage	Part	Yes, manager only	The usual labour on works of this sort	3s. 6d. to 5s. 9d. per day	£3 10s. per week
WANDSEAD ...	10,000	70,000	Rough screening tank, septic tank, contact beds, and under drained irrigation beds in addition	No	12	Irish rye grass	No	There is a resident foreman	One man with occasional additional help	24s. per week	25s. per week
WALTON-ON-THAMES	11,000	102,376	Settling tanks and broad irrigation. Sludge run off into drying beds and sold to farmers and others	—	24	Cabbage, mangolds and grass	Yes	Yes, under direction of surveyor	Stoker and six labourers ..	£9 per week	£2 per week and house
WATFORD	10,500 estimated	42,000	Chemical precipitation and filtration. Air-limo-ferric being the precipitant of six filters, 100 square yards each	—	8	—	Yes	Yes .. .	One man	5 —	32s. 6d. per week
YADON ...	7,659	23,000	Precipitation with lime, afterwards passed through artificial filters made of clinker	No	44	None	No	Manager under surveyor	One man for day work and one man for night work	24s. and 20s. per week	25s. per week

MUNICIPAL ASPHALT REPAIR PLANT

Result of Detroit's First Year's Work in Repairing Its Asphalt Pavements So Favorable That a Second Plant Is Wanted

By E. G. Pipp



C. A. PROCTOR
Asphalt Expert—in
Charge of Plant

WITH the books balanced on the first year's work of Detroit's municipal asphalt plant, showing an average of 87 cents a yard for all work done, Commissioner of Public Works W. H. Maybury recommends that a second plant be established so that the city can do all its own asphalt paving hereafter.

The plant was put in operation late in the season, June 8, and closed down after a run of twenty-two weeks. Its original cost was \$15,000. Figuring on a basis of last year's prices for patching and resurfacing it has more than paid for itself in the part of a season operated; has stood the losses incidental to the "experimental year," and the officials believe they have a better grade of work than the city ever got on contract.

Commissioner Maybury directed Asphalt Expert C. A. Proctor, a pupil of Prof. A. W. Dow, the Washington expert, to proceed with work cautiously, and to bend his efforts more toward getting good work than toward making a big record of yardage. Only patching was done at the beginning, followed later by resurfacing two streets. The total yardage laid is 56,591.95; the cost, \$49,187.70.

Eight hours constituted a day's work, under an ordinance passed by the city. Union labor was recognized in all departments, and the following rates were paid:

At the plant: Foreman, \$4 a day; mixer man, \$2.75; tank man, \$2.85; night tank man, \$2.40; hot sand man, \$2; drum fireman, \$2.50; engineer, \$3; fireman, \$2; laborers, 5 to 8, at \$1.75; clerk, \$3.50; bookkeeper, \$3; night watch, \$2.50.

On the street: Straight time paid, foreman, \$3.50 a day; two roller men, \$3; three rakers, \$3; two tampers, \$2.50; two smoothers, \$2.50; five laborers, \$1.75; teams, \$4 for eight hours; two gangs going part of the time.

Venezuelan asphalt was used, and California asphaltic oil. The following is the total cost:

Materials Received:

Asphalt,	895.25 tons at	\$25.50	\$22,828.88
Asphaltic oil,	381.72 tons at	25.90	9,886.55
Sand,	3606.82 cu. yd. at	.56	2,019.82
Binder stone,	2536.72 tons at	.90	2,283.05
Stone dust,	358.1 tons at	3.50	1,253.35
Coal,	350.54 tons at	2.65	928.93
Wood,	79.72 cords at	4.86	387.43
Cement,	44.50 bbls. at	.75	33.38
Lub. oil,			131.28

\$39,752.67

Inventory—Materials on hand:

Asphalt,	341.87 tons at	\$25.50	\$8,717.69
Asphaltic oil,	106.16 tons at	25.90	2,749.55
Binder stone,	30.00 tons at	.90	27.00
Stone dust,	10.00 tons at	3.50	35.00
Credit on old oil bbls. sold, etc.			333.58

Total cost of materials used..... \$11,862.82

\$27,889.85

Labor:

At Plant: per payrolls.....	\$10,722.88
On Street: per payrolls:	
Gang No. 1.....	6,384.98
Gang No. 2.....	3,935.32
Gang No. 3.....	254.67
Total cost of labor.....	\$21,297.85
Total cost, material and labor.....	\$49,187.70
Work performed and cost of same:	
Sq. yd.	
General patching, city work,	33,994.40 at \$00.836.. \$28,424.47
Private patching,	10,327.88 at .991.. 10,241.72
Resurfacing Jefferson avenue, Baldwin to Iroquois,	5,730.00 at .876.. 5,018.71
Resurfacing Fourth avenue, Michigan to Locust,	6,539.67 at .841.. 5,502.80
	\$49,187.70

The higher price shown for private work was due to the fact that the work consisted of repairing breaks along street



ROLLERS OF DETROIT ASPHALT REPAIR PLANT AT WORK

railway tracks where no binder could be used, necessitating the use of the more expensive topping material, and also in repairing cuts in various sections of the city, where much time was consumed in moving gangs.

On Jefferson avenue the asphalt had to be hauled over six miles, while on Fourth it was less than two.

In the earlier tests of mixture used, on patching only, there was an average of 10.98 per cent. bitumen; a maximum of 12.53, and a minimum of 10.55. When it came to resurfacing, the average was 11.93 per cent.; maximum, 12.13; minimum, 11.71.

The sand was graduated for compactness, showing the following siftings: Retained on 20-mesh screen, 6 per cent.; 40-mesh, 16 per cent.; 60-mesh, 26 per cent.; 80-mesh, 23 per cent.; 100-mesh, 11 per cent.; passing 100-mesh, 18 per cent.

On resurfacing, 1½-inch binder, and 2-inch topping were



SHOWING FINISHED WORK OF DETROIT ASPHALT REPAIR PLANT ON
JEFFERSON AVENUE

used; on patching, Mr. Proctor figures that it averaged about three inches.

No estimate is made here for guarantee on the streets resurfaced, as opinions differ so much as to what it should be that it is deemed best to let each expert figure it out for himself. It is claimed here that the quality of material used is so much better than ordinarily used that the expense of making good during time usually covered by guarantee will not be as much as usual, and that the amount charged against the street should be correspondingly small; only future years can tell about that.

The last job done convinces the department that the city can well afford to take all its own work in hand.

The common council and estimators allowed \$11,760 for resurfacing part of Fourth avenue. The asphalt paving representatives said it was not money enough. Commis-

sioner Maybury advertised for bids. The Cleveland Trinidad Paving Co., asked \$12,027.63 for repaving with asphalt, putting in a 6-inch concrete foundation on part, and building up 3½-inch concrete on the remainder, and resetting the curb. The Barber Company did not bid at all, although it bid on other work in the city during the season, and has a plant and office here.

The commissioner rejected the bid, and being told it was useless to expect a lower one than that received, put city gangs to work. The cost of concrete, etc., was \$2,777.83; the cost of asphalt, \$5,502.80; total, \$8,280.63; a saving of \$3,747.01 when compared with the bid for the work.

All figures used here are taken from the books of the department. To make sure there was no error in quantity of material used, the original bills were figured, an inventory taken of the amount of material on hand, and the difference checked up with the amount recorded as used on the various streets.

The plant, put up by Hetherington & Berner, of Indianapolis, has run through the season with but one shut-down, and that of less than five minutes, an average loss of time of less than a minute a month.

The idea of a second plant is to have one near the center of the east side of the city, as the present plant is near the center of the west side. The city is about evenly divided into two sections by the main thoroughfare, Woodward avenue. It has a storage yard for material in each section.

"I am not entirely satisfied with this year's showing," said Expert Proctor. "Our yardage was nowhere near the capacity of the plant, but, of course, we worked safe. Last year the patching cost \$1.12 a yard, and resurfacing averaged about \$1.23, an unusually low contract figure for cretrail. We saved from 13 cents a yard on the work done at the beginning of the season, to 39 cents a yard on the resurfacing done at the end, but with the experience of this year, we ought to get a much lower average cost next year by doing a much larger amount of work."

SUCCESS OF DETROIT'S MUNICIPAL ELECTRIC LIGHT PLANT

AFTER OWNING its own electric light plant for nine years, the city of Detroit, Mich., has proved that municipal ownership of electric light system is a success. Where formerly the city paid a private corporation \$132 per arc light per year, the yearly cost per arc light now is \$61.65, or more than 50 per cent. less.

In the plant there are seven double-deck tubular boilers of the C. C. Peck design, in the boiler house. Each boiler contains 3,000 square feet of heating surface and is equipped with the Hawley Down Draft Furnace and Hoppe's Live Steam Purifier and Worthington Water Meter. Five of these boilers are in constant use. The other two are held in reserve. Every six weeks the boilers are changed. When a boiler goes out of commission it is given a complete overhauling and cleaning. One of the reserve boilers takes its place. The plant is so situated that a switch has been laid and the coal can be unloaded directly from the cars

to the bins. A track scales has been put in and all coal that is bought is weighed on it.

The arc lighting plant contains four triple-expansion, marine type engines; 200 revolutions per minute; 160 pounds steam pressure. To each engine are connected four 50-kilowatt, four-pole, Western Electric Company arc dynamos. This plant at present supplies electricity to 2,597 arc lamps.

A unique feature about the street lighting of Detroit is what is called the tower system. Several arc lights are placed on a skeleton-like tower. These towers range in height from 100 feet to 165 feet. The majority, however, are 150 feet high. Some of these towers have six arc lamps at the top.

All of the wires of the lighting system, within a half mile circle and a greater portion of them within mile circle, are underground.



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Milwaukee's Garbage Problem

THERE are few municipal problems that require more immediate solution than that of garbage collection and disposal. The city of Milwaukee, just at the present time, is passing through a trying and expensive experience. Only a few months ago it completed, at an aggregate cost of \$60,000, a garbage destructor, and now is obliged to close it temporarily for needed repairs. The local newspapers seem to take an unreasonable view of the situation and to throw too much blame on the so-called failure of the system, whereas even to the casual observer the reasons for the failure of the plant are apparent. In the first place, the wrong location was selected for the plant. Jones Island, the site of the plant, is not much more than a sand hill, between the Kinnickinnic River and Lake Michigan. There was no objection raised to its establishment at this point, as it is practically isolated from the city. This isolation seemed necessary to prevent any possible nuisance within the city limits, as everybody supposed that the plant would be a nuisance. This location is inaccessible, and necessarily increases the expense of hauling, thus making the aggregate cost greater than it should be.

The crematory itself was partly built on made ground, or marshy sub-soil, so that part of the foundation rests on piles, while another portion of the building rests on sand only. This inequality in the stability of the foundation has naturally made the building settle on one side, and therefore it becomes necessary to close the plant temporarily for needed repairs.

Instead of berating the city officials for the so-called failure of this plant, the press of Milwaukee should undertake to educate public opinion to such an extent that it would

not fear the establishment of a garbage plant right in the heart of the city. It is a fact that garbage may be destroyed and handled sanitarily without causing a nuisance anywhere in the city, for it has been so demonstrated for years in the city of New York and in many English cities. For example, institutional crematories in connection with the largest hospitals in the city of New York have been operated for years, and without nuisance of any kind, although the most offensive matter has been destroyed. In English cities, garbage crematories are not infrequently placed next to public buildings, public schools and private residences, and without causing the slightest nuisance.

Milwaukee should abandon the old plant altogether and construct two smaller plants, locating them centrally, and so largely reduce the expense of operation by decreasing the length of the haul. Milwaukee is not alone in this dilemma, for most of the larger cities in the United States are experiencing the same difficulties. St. Louis, now that the Fair is over, is taking up the garbage question with unusual vigor, and proposes to erect three garbage destructors in the most accessible parts of the city. New Orleans is also ready to solve the problem. The city of Mexico is maturing plans for the erection of a plant that will handle 250 tons per day. To mention all the cities would be to include almost a complete list of the larger cities of the country, for America has made very little progress in this field within the past ten years. The practice in English cities can be followed in this country to great advantage.

Municipal Lighting for New York

THE light corporation of New York City seems to have overreached itself in demanding payment for its services at exorbitant rates. During the Low administration, Col. Robert G. Monroe, who was Commissioner of Water Supply, Gas and Electricity, rejected all bids for lighting, on the grounds that they were exorbitant, and the matter has hung fire until recently, when the matter was decided by Commissioner Oakley and a compromise effected whereby the company agreed to remit the interest charge on the accumulated light bills and reduce the price on some of the arc lamps from \$146 to \$140 per year. This action met with such a storm of objections from all quarters that Mayor McClellan took the matter in hand and recently presented the following resolution to the Board of Estimate and Apportionment, which was unanimously adopted:

"Resolved, That the Corporation Counsel be requested to furnish to this board as promptly as possible his opinion whether there is power in this city under its present charter to construct and maintain a plant for furnishing electric lighting to the public buildings and streets of the city."

This action may lead to the establishment of a municipal electric light plant for the city of New York. Steps have already been taken to introduce the necessary bill at Albany to authorize such a plant. The situation is by no means hopeless, so far as the city is concerned; as a matter of fact, it seems to be in a better position than ever to obtain its just dues and resist every imposition by the powerful corporations.

Col. Monroe, in a recent public address upon the subject,

puts the situation tersely, as follows: "I fully realize that the Edison company is powerful; that the Consolidated Gas Company, which owns the Edison company, is more powerful; and that the Standard Oil interests, which control the Consolidated, are more powerful still, but the strongest corporation in this State is the city of New York, and its residents, all of whom are stockholders in the municipal corporation, need not submit to any imposition against their will." Whether New York builds a municipal light plant or not it ought not to be obliged to pay even \$100 per year for light, much less, \$146. At present, the powerful corporations practically run the town for their own pockets, but the time is coming when they will be satisfied with reasonable returns.

Mayor Brouse Does Not Favor One-Man Power

MAYOR M. A. BROUSE, of Kokomo, Ind., has recently corrected a misunderstanding of his position in regard to home rule in the police department, and as the MUNICIPAL JOURNAL is, perhaps, to be included among those making the misstatement, it is pleased to quote his own words in correction, which are taken from a letter addressed to the South Bend, Ind., *Tribune*:

"It is not to have 'a one-man power over the police and fire department with a vengeance,' but it is the idea that if you have home rule, and that was the sentiment of the municipal meeting at South Bend, that instead of a one-man power, which would be the Mayor, and which virtually is in cities operating under a special charter, that this be turned over to a commissioner or board elected directly by the people, so that that board or commissioner will be expressing the direct sentiment of the people.

"In other words, the amendment that was before the Municipal league at South Bend to repeal the metropolitan police law, which would then throw the control of the police into the hands of the council, was largely voted down by the league that met in your city, as it was fully expressed that they did not want that matter to be handled by the council."

Granite Block Pavement Too Noisy

Now that the automobile truck and other horseless vehicles are coming into such general use there is some probability that our cities will get rid of the antique granite block pavement. Nothing is to be said against its durability, but as to its slippery, noisy, rough and unsanitary characteristics it is unendurable. In foreign cities there has been, for a number of years, a growing and popular prejudice against it. Edinburgh, Scotland, is among the latest to advocate the abatement of the granite nuisance. Yielding to this popular demand the city has resolved in favor of the more general use of hard wood and the smoother forms of pavement, where the grades will permit.

Following the best practice in this country in the use of the modern wood block pavement, the street committee of Edinburgh has ordered that in laying new wood paving the blocks shall be treated with a preservative and laid close in the joints and grouted with pitch. The chairman of the committee says: "The adoption of such a system

will, by reason of its compactness, effect a reduction in the wear and tear of the blocks and at the same time prevent water from finding its way through the joints and causing rot at the bottom; it will, also, to a large extent, prevent the expansion which usually takes place where open joints and cement grouting exist."

The average cost of wood paving (Australian hard wood) in Edinburgh has been \$3.28 per square yard, and the average life ten years. At present there are eighty-one miles of granite pavements, eighty miles of macadam, and about three miles of wood in Edinburgh. The committee favors wood block pavements for the streets with heavy traffic, asphalt for localities where the vehicular traffic is not heavy, and bituminous macadam or bitulithic, as it is called in this country, for the suburban and residential districts.

The smooth pavements are obtaining the recognition in American cities which they have long deserved, and it is only a question of a few years when the popular demand for their general use will be irresistible. Such pavements as the properly laid asphalt, bitulithic, brick and wood block will soon supplant altogether the Belgian and granite block.

Editorial Comment

THE overhead wires of the street railway, telephone and telegraph companies, in fair weather as well as foul, are a constant menace to human life. Accidents are a matter of daily occurrence in the larger cities, and frequent enough in towns and villages to make it necessary to enact a state law requiring all wires to be placed underground. Conduit construction has become so reasonable in price that such a law would be no hardship on the owners of wires.

THE Indianapolis *News* thinks that, "voting machines have become sufficiently well known to cease the tentative attitude in regard to them. They are certain to be adopted in time. But it is apparent that under the permissive law, as we now have it, Indiana is a 'leetle slow,' and it would be far wiser to take the short cut and make the use of machines compulsory at the next general election. We should save money enough in a few elections to pay for them, and we should save almost everything else that is desirable to have with elections." This would be a wise law to enact in every state provided the machines could be sold on the instalment plan, and paid for out of the savings accruing from their use by the city, town or village.

A CORRESPONDENT of the Kansas City *Star* suggests that a business district be defined, within which the Council shall have absolute power to pave streets and to designate the kind of pavement to be used. This has been demonstrated as bad practice in cities where it has been tried. The only department which should have the power to designate the kind of material to be used on any street is the City Engineer's or Highway Department. The reason for this should be obvious to even the lay mind. Councilmen are not paid for engineers' work, and are not competent to judge of the availability of any kind of paving material for given streets.

THE "trash" cans which are owned and operated by a private company in Kansas City, have become such a nui-

sance that the citizens want the Council to repeal the franchise. It seems that the conditions of the franchise have not been met, in that the cans have not been kept in good condition. For instance, dead animals and other refuse have been allowed to remain in the cans so long that they have become a nuisance, and a menace to public health. This belongs to a class of city work which can be better and more economically performed by the municipality. Kansas City will act wisely if it repeals this franchise and does the work itself.

THE Park Department of the American Civic Association has recently started a publication known as "Items of Park News." This bulletin contains a lot of interesting news and information about the parks of American cities. The editor is Mr. G. A. Parker, who is one of the department vice-presidents of the association. Mr. Parker has the finest collection of material relating to the construction, maintenance and administration of park departments, including every detail of work, that can be found in the country, and a person better qualified to fill this position could not be found. This bulletin will be sent gratuitously to all the members of the American Civic Association interested in park matters, to correspondents and to all others who write for them, so long as the edition lasts. All letters of inquiry should be addressed to Mr. G. A. Parker, P. O. B. No. 397, Hartford, Conn.

A PET scheme of Park Commissioner Pallas, of New York, of letting out the walls and fences of the public parks for advertising purposes, and for the purpose of obtaining nominal revenue, has been knocked in the head by the recent decision of Supreme Court Justice Scott, who granted the application of Mr. Calvin Tompkins, president of the Municipal Art Society, for an injunction permanently restraining both Mr. Pallas and his advertising friends from using the temporary fence surrounding the new public library for advertising purposes. This is really an encouraging sign of the times, and strengthens the hope that ultimately the city may prevail against the Interborough Railway Company and have the advertising signs thrown out of the subway. At any rate, there is no necessity for the great city of New York going into the advertising business for the sake of deriving an insignificant revenue from billboard advertising.

THE city of Indianapolis has declared war on the Indianapolis Gas Company through an ordinance placing the price of artificial gas for fuel purposes at 50 cents for 1,000 cubic feet, and the company has been ordered to cease furnishing fuel gas or comply with the ordinance.

The city asserts that while the gas company's franchise permits it to furnish illuminating gas at 90 cents it does not give it authority to sell gas for fuel purposes at any price; that the company has turned artificial gas into its old natural gas mains and is thus enjoying a privilege which was not contemplated in the franchise. Hundreds of families when deprived of natural gas by exhaustion of the field have resorted to artificial gas and are now using it extensively.

This ordinance seems to be a new and ingenious way of resisting the encroachments of corporations which endeavor to grasp privileges not intended to be given them in the franchise.

Personalities

—Mayor W. C. Finke has been re-elected mayor of California, Mo.

—At the recent municipal election at Hickory, Miss., F. W. Hanner was elected mayor.

—At the election held recently at Oglethorpe, Ga., Mr. W. H. Gardner was elected mayor.

—Mr. A. O. Baker has resigned as superintendent of the water works and electric light plant at Wellington, Kan.

—St. Albans, Vt., has a new superintendent of the Street and Water Department, in the person of Mr. A. Warren Clark, who succeeds Mr. Harry F. Lincoln.

—Mr. John W. Lux has been appointed by Mayor Smith of St. Paul, Minn., to take the place on the water board of W. H. Elsinger, who recently resigned.

—Professor A. S. McAllister, of Sibley College, of Cornell University, has resigned to accept an editorial position with the *Electrical World and Engineer* of New York City.

—Wallace C. Johnson, M. Am. Soc. C. E., has been appointed by Governor Odell, of New York, as Engineering member of the River Improvement Commission of New York State.

—The salary of George W. Dickensheets, city treasurer of Gloucester City, N. J., has been increased from \$600 to \$1,000 per year. The change will take place on the first of January, 1905.

—The City Council of Muncie, Ind., on December 12, elected Henry W. Warner to succeed his brother, W. F. Warner, who had lately resigned as superintendent of the electric light plant.

—Hon. John W. Earhardt has resigned as mayor of Newberry, S. C., to enter the State legislature as representative from Newberry county. Dr. Van Smith has been elected mayor *pro tem*.

—At the recent municipal elections held in Mississippi, Captain J. J. Denson was elected mayor of Silver Creek, S. P. Head was elected mayor of Terry and J. D. Carry was elected mayor of Newton.

—Mr. A. J. Pray, who is a leading representative in the Pittsburg Water Meter Company, has lately been appointed a member of the Park Commission by Mayor Jeffrey, of Columbus, O. Mr. Pray resides in Columbus.

—Mr. James A. Green has resigned as assistant in civil engineering course, in the University of Nebraska, to accept the position of assistant State engineer of Nebraska, succeeding Mr. Ray D. Hubbard, lately resigned.

—At a dinner recently given at the Manhattan Club in New York City, Contractor John B. McDonald was presented with a bronze statue of the Winged Victory in acknowledgment of his construction of the subway.

—The city authorities of Chicago, Ill., and the elevated railway companies have selected B. J. Arnold, M. Am. Inst. El. Engrs. to investigate and discover some means of reducing the noise in connection with the operation of the elevated systems.

—Mr. Frank F. Rogers has resigned his position as civil engineer to the Port Huron Engine and Thresher Company of Detroit, Mich., and has again entered into a general engineering practice in that city, making a specialty of roads and municipal work.

—At a recent meeting of the board of aldermen of Richmond, Va., it was voted to raise the mayor's salary from \$2,000 to \$3,600 per year. The ordinance only awaits Mayor McCarthy's signature when he will receive the increase starting from September 1, 1904.

—Attorney-General Cunneen recently obtained at Kingston an order from the Supreme Court to show cause why John Brown, president of the village of White Plains, N. Y., should not be removed from that office for accepting and riding on a pass of the New York Central Railroad.

—At the annual meeting of the Engineers' Society of Western New York, held at Buffalo on December 6, Mr. George H. Norton was elected president; Mr. Alfred T. Thorn, director; Mr. Harry B. Alverson, secretary; Mr. Frank N. Speyer, treasurer; Mr. William A. Haven, librarian.

—Mr. Thomas H. McGraw, superintendent of the City Water Department of Dallas, Tex., met his death on December 2. His body was found under a railroad bridge and it is not known whether his death was accidental or suicidal. He was fifty years of age and had been connected with the water department for nineteen years.

—William Barclay Parsons, M. Am. Soc. C. E., of New York City, has tendered his resignation as chief engineer of the Rapid Transit Commission, to take effect as soon as he can be spared. He will open an office for consulting practice and in January will go to Panama in connection with his work as a member of the Canal Commission.

—By the sudden death of City Clerk Emery D. Ireland, Atlantic City, N. J., loses one of its most patriotic, earnest and unselfish citizens. In speaking of him Councilman Parker said: "He was always painstaking and accommodating and he was ever ready to do a favor and extend a courtesy." His successor is Edward R. Donnolly, the former clerk of the district court.

—Hon. Charles S. Ashley (Dem.) has been elected mayor of New Bedford, Mass., for the eleventh time. Other successful candidates for the mayoralty in Massachusetts were Edward H. Keith (Rep.), of Brockton; Henry O. Sawyer (Citizen), of Fitchburg; George E. McDonald (Rep.), of Gloucester; Roswell L. Wood (Rep.), of Haverhill; Cornelius F. Lynch (Dem.), of Lawrence; Henry Parsons (Rep.), of Marlborough; Theobald M. Connor (Dem.), of Northampton; Allen H. Bagg (Rep.), of Pittsfield; James Thompson (Rep.), of Quincy; Francke W. Dickinson (Rep.), of Springfield; John H. Eldridge (Rep.), of Taunton; John L. Harvey (Rep.), of Waltham; John T. Coughlin (Dem.), of Fall River; Albert E. Taylor (Rep.), of Chicopee; Nathaniel P. Avery (Rep.), of Holy-

oke; M. F. Dwyer (Citizen Rep.), of Medford; J. A. Wallis, of Beverley; William A. Hastings, of Malden; H. H. Newton (Rep.), of Everett.

Macon and Its Mayor



The present mayor of the city of Macon in the State of Georgia, Mr. Bridges Smith, is so intimately connected with its pride, prosperity, progress and enterprise that he might gracefully emulate the example of Louis XIV and exclaim *l'etat c'est moi!*

For ten years prior to entering public life, Mayor Smith was actively engaged in journalism. In 1899 he was elected mayor without opposition and in the following year was reelected notwithstanding the fact that he was opposed by two popular citizen candidates. In 1903 he succeeded himself without opposition. Under his administrations the city has been greatly improved, many streets being paved after the best modern methods. The police have been put under the three relief system and the fire department enlarged. Many other public improvements are under way.

The city hall and auditorium which is a feature of Mayor Smith's *régime* stands as a relic of the architecture of *ante bellum* days, with its large, tall columns and flat roof. It was built in 1838 for a railroad and banking company, and after a few years was used by a cotton firm. In 1859 it was sold to the city for a city hall, and has been used continuously for this purpose save two or three years during the war when the Confederacy converted it into a hospital. It has a frontage of fifty feet. The people, however, wanted an auditorium, and as the hall was becoming entirely too small for the government, it was thought best to combine the two, and an addition of eighty-eight feet is now being built, which will make a total frontage of 138 feet. In the combination of city hall and auditorium, the same colonial style of architecture has been preserved. It will present a magnificent front, possibly the finest appearance of any city hall in the country.

Through the efforts of the mayor, the League of Georgia Municipalities was organized. He was its president for two years and is now its secretary. The league is one of the best of its kind in the country. Mayor Smith is vice-president of the Chamber of Commerce, director in the Macon Fair Association, and secretary and president of the following organizations: Organized Charity Societies, Price Free Library, and the Macon Police Relief Association.

The population of Macon in 1900 was 23,272, and the assessed valuation \$14,782,637. The city owns its sewers, parks, playgrounds and its fire- and police-alarm telegraphs. The water and gas works, electric lights, railways and telephones are controlled by companies. The water supply is obtained from the Ocmulgee river by pumping. The garbage is disposed of in a home-made crematory.

Macon is an attractive city. In the words of its mayor the climate is the most delightful in the world, and the city is up to date.

American Society of Municipal Improvements

A. Prescott Folwell, President

Easton, Pa.

George W. Tillson, Secretary
Municipal Building, Brooklyn, N. Y.

THE American Society of Municipal Improvements aims, among other things, to obtain and communicate to its members—and indirectly to the public—information concerning physical improvements in municipalities. This information may be presented in the shape of formal papers on certain topics, of reports upon the progress made in and present status of certain branches of municipal improvements, and of discussions upon these. Many municipal officers voluntarily and generously contribute their time and information to the society in valuable papers; but many data and important contributions can be obtained only by soliciting them from those able to furnish them, after first discovering who these are.

According to a wise provision of the constitution of this society the field to which it devotes its attention is subdivided into sections, now eleven in number, in charge of each of which is placed a committee appointed annually by the president. Each committee prepares for presentation to the society a report upon its particular section, solicits papers from those whom it knows to have valuable information on the subjects under its charge, makes investigations of its own in such subjects and generally endeavors to promote the interests of the society in its own allotted territory. Since it is so generally true, where responsibility is shared in common by a large number, that "what is everybody's business is nobody's business," it is evident that upon the faithfulness and diligence of these committees depends, to a large extent, the benefit which the society obtains in the form of information contributed; and great care is taken in selecting the members constituting them. Those appointed for the year ending with the next annual meeting are as follows:

Committee on Street Paving

C. D. Pollock, chairman, Brooklyn, N. Y.; Walter F. Reichert, Little Rock, Ark.; Fred Giddings, Atchison, Kas.

Committee on Electric Street Lighting

E. A. Fisher, chairman, Rochester, N. Y.; B. T. Fendall, Baltimore, Md.; Fred A. Snyder, Summit, N. J.

Committee on Sewerage and Sanitation

E. S. Rankine, chairman, Newark, N. J.; J. N. Hazelhurst, Mobile, Ala.; Ed. J. Johnson, Nashua, N. H.

Committee on Water Works and Water Supply

D. W. Mead, chairman, Chicago, Ill.; A. J. Provost, Jr., Brooklyn, N. Y.; E. S. Barrow, Hamilton, Ont.

Committee on Taxation and Assessment

N. P. Lewis, chairman, New York; Aug. Herrmann, Cincinnati, O.; F. H. Woods, Toronto, Ont.

Committee on City Government and Legislation

Wm. S. Crandall, chairman, New York; Julian Kendrick, Birmingham, Ala.; Thos. Neville, Rochester, N. Y.

Committee on Disposition of Garbage and Street Cleaning

B. E. Briggs, chairman, Erie, Pa.; Robert Allison, Cincinnati, O.; L. W. Anderson, Grand Rapids, Mich.

Committee on Municipal Franchises

James Owen, chairman, Newark, N. J.; Chas. H. Rust, Toronto, Ont.; J. R. Barlow, Montreal, Canada.

Committee on Review

C. C. Brown, chairman, Indianapolis, Ind.; N. I. Ker, Ottawa, Canada; T. Chalkley Hatton, Wilmington, Del.

Committee on Municipal Data and Statistics

Wm. Fortune, chairman, Indianapolis, Ind.; H. W. Wilmot, New York; H. N. Ruttan, Winnipeg, Man.

Committee on Park Development and Maintenance

G. A. Parker, chairman, Hartford, Conn.; J. W. McClintock, Boston, Mass.; A. D. Richey, Elwood, Ind.

Convention Dates

January.

—The American Public Health Association will meet at Havana, Cuba, January 2-6, 1905. Dr. Charles A. Probst, secretary, Columbus, O.

—The annual meeting of the Michigan Engineering Society will be held at Lansing, Mich., January 11-13, 1905. F. Hodgman, secretary, Climax, Mich.

—The annual meeting of the Kansas Municipal League will be held at Topeka, Kan., January 9-11, 1905. W. A. Bird, secretary.

—The annual meeting of American Society of Civil Engineers will be held in New York, January 18 and 19, 1905. Charles Warren Hunt, secretary, 220 West Fifty-seventh street, New York.

The annual meeting of the Canadian Society of Civil Engineers will be held at Montreal, January 24-26, 1905. Prof. C. H. McLeod, secretary, 877 Dorchester street, Montreal, Que., Can.

February.

—National Brickmakers' Association will meet for its nineteenth annual convention at Birmingham, Ala., January 30 to February 11, 1905. T. S. Randall, secretary, Indianapolis, Ind.

March.

—The International Society of States and Municipal Building Commissioners and Inspectors will meet at Washington, D. C., March 2-4, 1905. F. W. Fitzpatrick, secretary, 1431 Welling place, Washington, D. C.

October.

—American Society of Municipal Improvements will meet at Montreal, Can., some time in 1905. George W. Tillson, C. E., secretary, Municipal building, Brooklyn, N. Y.

—The League of American Municipalities will meet at Toledo, O., in 1905. Hon. John MacVicar, secretary, Des Moines, Ia.

Meter Rates in Cities of 100,000 Population

THE following table gives the rates of metered water in the thirty-eight cities of over 100,000 population. Only the highest meter rate, which is given to the ordinary house consumer, and the lowest rate, which is given to the largest consumer, and the smallest minimum a year, if there is a minimum, are mentioned.

Place.	Highest Rate.	Minimum.	Lowest Rate.
1. New York	\$0.10	—	\$0.10
2. Chicago <i>a</i>	.10	—	.04
3. Philadelphia <i>b</i>	.04	\$8.00	.04
4. St. Louis	.30	—	.10
5. Boston	.18 2/3	15.00	.10 2/3
6. Baltimore <i>c</i>	.06	—	.06
7. Cleveland <i>d</i>	.05 1/3	2.50	.05 1/3
8. Buffalo <i>e</i>	.06	5.00	.02
9. San Francisco	.33 1/3	—	.16
10. Cincinnati	.11 2/3	—	.08 2/3
11. Pittsburg	.18	8.00	.06
12. New Orleans	.25	—	.07 1/2
13. Detroit <i>f</i>	.05 5/6	7.00	.02 1/4
14. Milwaukee <i>g</i>	.06	—	.09
15. Washington	.03	—	.03
16. Newark	.15	—	.09
17. Jersey City	.20	—	.10
18. Louisville	.15	—	.06
19. Minneapolis	.08	4.00	.08
20. Providence	.20	10.00	.15
21. Indianapolis <i>h</i>	.18	16.20	.04 1/2
22. Kansas City	.31	—	.05
23. St. Paul	.13 1/2	—	.06 2/3
24. Rochester	.14	5.00	.10
25. Denver	.17	3.00	.10
26. Toledo <i>i</i>	.10	—	.03 1/2
27. Allegheny	.10	—	.10
28. Columbus	.08	—	.08
29. Worcester	.25	—	.10
30. Syracuse <i>k</i>	.18 2/3	5.00	.04 2/3
31. New Haven	.18	—	.13 1/3
32. Paterson	.30	12.00	.06 2/3
33. Fall River	.21	—	.07 1/2
34. St. Joseph	.30	12.00	.06
35. Omaha	.35	—	.10
36. Los Angeles	.07	12.00	.07
37. Memphis	.40	24.00	.10
38. Scranton	.20	—	.06

a On the excess above 5,000,000 gals. per month, with 15 per cent. discount for prompt payment.

b City has no money to set small meters.

c Owner must pay for meter and keep it in repair.

d There are other minimums of \$4, \$6, \$8, etc., according to the assessment rate and size of the meter.

e Consumer pays for setting small meter.

f No meter unless rate is over \$7, and customer pays for setting meter.

g Customer pays \$1 per year for reading.

h Minimum is 5 cents in excess of 1,500,000 gals. per month and 4 1/2 cents in excess of 1,875,000 gals. per month.

i On excess above 170,000 gals. per day.

k On excess above 428,000 gals. per month.

Municipal Clinker Bricks.

AN inquiry has been held at West Hartlepool, England, by an inspector of the Local Government Board into an application by the Town Council for power to borrow \$16,000 for the provision of buildings and plant for the manufacture of bricks from clinker from the destructors. The Borough Engineer stated that the corporation had from 800 to 1,000 yards of clinker for which they had no outlet at the present time. It was estimated that on three years' working of the destructor there would be a surplus of over 3,000 tons of clinker for brickmaking purposes, and this

quantity would make about 2,900,000 bricks. There were many important works in progress and contemplated in the town, and the corporation proposed to use the clinker bricks in these works and sell the surplus. If properly manipulated the scheme ought not to entail any expense on the rates. Mr. Dennis submitted a sample brick manufactured at Leeds, and stated that a similar brick required a weight of 355 tons to crush it. It was pointed out that the cost of manufacturing these bricks would be from \$3.30 to \$3.62 per thousand. This would cover every possible expenditure. He also stated that one year's production from the proposed plant would be sufficient to pay the principal and interest for four years on the suggested outlay.

Apropos of this subject, *The British Clayworker*, which opposes municipal brickmaking, says:

"The subject of municipal brickmaking keeps cropping up here and there, so that we have occasion from time to time to comment on it.

"All that is needed is that the word should go forth that some waste product is to be disposed of, and at once the civic mind turns to brickmaking. Anything will do to make bricks, and even a town councillor is qualified to judge of the possibility of turning it to account in this way. 'Relief of the Rates' is the by-word that is so alluring, and proposals are immediately set on foot to install expensive plant and enter on the highly technical and uncertain business of brick manufacturing.

"The latest scene of this unwarrantable intrusion of municipalities into the domain of the manufacturer is West Hartlepool, where it is under consideration to make bricks of destructor clinker. There is a "surplus" of this excellent material which cannot be got rid of, and it is contended that one year's production of bricks would suffice to pay the principal and interest for four years! The arithmetic of this statement is somewhat of a puzzle in municipal finance. We leave it to our readers to solve!

"It is proposed to build the factory on make-up water-logged ground and use the bricks for important works in the town. All this in a town of 62,000 inhabitants, and in which there are 1,400 empty houses! This proposal is similar to one which was mooted some time back at Brighton; one which we were instrumental in no small degree in nipping in the bud.

"It is, however, too late to prevent the probable waste of public money at West Hartlepool. A tender amounting to \$10,910 has been accepted for plant, and a further \$5,000 be spent on buildings.

"Councils are invariably jealous of each other, or West Hartlepool might take to heart the experience of the London County Council, which recently spent some thousands of pounds on brickmaking at Norbury, and found the bricks too bad even for their own use!

"It is really time that the Local Government put its foot down strongly and refused to entertain these absurd proposals to take up industries which the councils not only know nothing whatever about, but have no possible excuse for meddling with."

Brick Pavements in Covington

STREET IMPROVEMENT is a matter of particular pride to the citizens of Covington, Ky., who have been spending, for the past three years, \$80,000 per season on walks and pavements, the appropriation to continue for three years to come, and all without the issue of a dollar in bonds.

Most of the pavements are a repressed, vitrified brick,



SCOTT STREET, COVINGTON, KY., PAVED WITH BRICK

with an absorption limit of $2\frac{1}{2}$ per cent., the Athens block, Townsend block, and Portsmouth block, of a size $3 \times 4 \times 8$, being the best obtainable in that locality. The soil is alluvial and of a very light sandy clay with occasional quick sand, and is first covered with a bed of concrete made of Portland cement—usually Lehigh, Saylon, Nazareth or Vulcanite—and sand, in a ratio of one to three, and sufficient to thoroughly envelop the broken stone. The concrete is six and one-half inches deep, and is thoroughly rolled and then covered with a sand cushion of one and one-



GREENUP STREET, COVINGTON, KY., PAVED WITH BRICK

half inches, making a total thickness with the brick of twelve inches. The brick are rolled and then filled with a rich Portland cement grout of a ratio of one to one, and a tar filler for expansion is used along each side and across street at 25-foot intervals. The gutters and curbs are of cement.

There are over three miles of asphalt pavement in the city, which was built twelve years ago, but the expense of

keeping it in repair has created a sentiment opposed to its extension. An effort was made last season to introduce creosoted block paving, but was thwarted by efforts at lobbying on the part of the competing companies, which disgusted the citizens who are determined to keep politics and corruption out of their city affairs.

Local improvements are paid one-half by the city and the contractor collects the other one-half from the abutting property owners.

Municipal Ownership in Ontario

THE city of St. Thomas owns and operates the six miles of electric street railway within its corporate limits. The road gives general satisfaction as to service, but at the expense of a deficit ranging between \$3,000 and \$4,000 per annum. The city owns and operates the waterworks system very successfully. This plant nets a small annual surplus and at the same time gives entire satisfaction. The city is now about to take over the plant of the Gas and Electric Company, and a board of arbitration is at present engaged in settling a difference of valuation between the city and the private corporation owning the property.—*Consular Reports.*

Municipal Insurance as a Means of Revenue

THE city officials of Alameda, Cal., are worried how to meet the growing expenses of a growing city. It has been suggested that the city go into the insurance business.

Chief Krauth has pointed out that the taxpayers pay the insurance companies from \$50,000 to \$100,000 per year, and the cost of fires, at least for the last five years, has not averaged over \$8,000 per annum. The maintenance of the fire department costs the city \$20,000 per year.

By running an insurance business, the city would be able to pay the expenses of the fire department, out of the profits and have money to spend on other departments.

The taxpayer would gain by such an arrangement in that there would be no risk of the insurance company's going into bankruptcy.

Conduit and Lighting Conditions in United States

MR. ARTHUR PARENT, superintendent of the Light Department of Montreal, in a report of extended investigation of the lighting conditions in the cities of the United States, shows that the percentage of electric lamps served by underground wires is: Baston, 40 per cent.; New York, 60 per cent.; Philadelphia, 10 per cent.; Baltimore, 12 per cent., and Washington, 99 per cent.

Philadelphia is the only city he visited where the city's contract regulates the price of gas to the citizens. The municipal gas plant is leased to a corporation, and it is stipulated that the charge to consumers shall be \$1.00 per 1,000 C. F., and that the price shall not be reduced by ordinance below 90 cents prior to 1908; below 85 cents prior to 1913; below 80 cents prior to 1918, or below 75 cents prior to 1927.

He also shows how Baltimore, by preparing to install a municipal plant, compelled the gas companies to reduce their rates.

"Municipal Trading Relieves Rates"

Mr. James Carter, the borough treasurer of Preston, England, and an authority on municipal statistics has prepared a table, which is published below, to illustrate the several items for which taxes are levied and the reduction from such sources as rentals of markets, gas, water, electric lighting, street railways and estates, in eighty-eight English cities ranging in population from 22,000 to 723,000.

It is interesting to note that there is a much more con-

HOW RATES ARE REDUCED

Town.	Markets.	Gas.	Water.	Electric light.	Tram-ways.	Estates owned.	Other sources.	Total Profits.	Amount in the £ by which rates reduced.
Accrington	£ 500	—	—	—	£ 150	—	—	£ 60	s. d. 738 0 14
Ashton-under-Lyne	1,118	—	760	—	—	—	—	—	1,878 0 21
Barrow-in-Furness	—	9,000	—	—	—	1,000	300	10,300	0 9 1/2
Bolton	2,000	16,380	10,000	4,500	2,740	1,900	—	37,520	1 1 1/2
Bath	—	—	1,000	—	—	9,500	500	11,000	0 9
Bacup	119	—	—	—	—	—	14	133	0 0 1/2
Birkenhead	—	6,000	3,000	—	—	—	—	9,000	0 3 1/2
Belfast	4,950	21,580	—	—	3,500	—	—	35,030	0 8
Blackburn	3,700	—	—	—	6,000	—	—	—	—
Blackpool	—	14,907	—	2,000	500	—	—	17,407	0 9 1/2
Bradford	1,774	—	—	—	—	—	—	1,774	0 0 1/2
Brighton	400	—	6,000	—	—	—	1,200	7,600	0 2 1/2
Burton-on-Trent	112	5,000	—	—	—	—	—	5,112	0 4 1/2
Burnley	550	7,100	—	4,100	—	—	300	12,050	0 9
Bury	276	1,500	—	300	—	—	710	3,786	0 4
Bristol	2,009	—	—	—	—	24,225	—	26,234	0 3 1/2
Bournemouth	—	—	—	—	—	—	1,500	1,500	0 0 1/2
Carlisle	—	6,969	6,350	—	—	2,101	1,054	16,474	1 8
Chester	1,280	—	—	—	—	2,683	—	3,963	0 4 1/2
Coventry	—	2,000	3,500	—	—	1,000	—	6,500	0 6
Cardiff	—	—	—	3,000	—	5,104	—	8,104	0 2
Darlington	686	8,500	6,300	—	—	—	—	15,486	1 7 1/2
Darwen	—	967	—	—	—	—	—	967	0 1 1/2
Derby	2,600	—	—	—	—	9,800	5,300	17,700	0 9
Dewsbury	—	5,376	—	1,000	—	—	—	6,376	1 1
Devonport	—	—	—	—	584	—	962	1,546	0 1 1/2
Dudley	1,040	—	—	—	—	—	—	1,040	0 2
Eastbourne	—	—	—	—	—	1,156	—	1,156	0 0 1/2
Exeter	350	—	200	—	—	1,650	800	3,000	0 3
Halifax	112	7,900	—	2,500	—	—	4,929	15,441	0 8 1/2
Hastings	—	—	3,034	1,500	—	—	7,060	8,594	0 5
Heywood	—	1,200	—	—	—	—	—	1,200	0 3
Kings Lynn	633	—	—	—	—	2,214	433	3,280	0 9 1/2
Kingston-upon-Hull	3,119	—	5,000	—	11,500	15,900	11,910	47,429	0 10 1/2
Lancaster	—	—	4,133	—	—	2,449	—	6,582	0 8 1/2
Leicester	2,317	25,000	—	—	—	6,048	9,730	43,095	0 8 1/2
Leeds	—	30,000	15,000	—	55,000	—	—	100,000	1 0
Liverpool	16,337	—	—	10,298	32,081	59,697	—	158,413	1 0
Lincoln	—	2,500	750	—	—	2,200	650	6,100	0 6
Macclesfield	—	5,005	624	—	—	144	—	6,773	1 4
Manchester	14,000	60,000	—	—	51,000	—	—	125,000	0 9
Middlesbrough	159	—	—	—	—	—	1,250	1,409	0 1 1/2
Northampton	1,907	—	2,772	—	—	450	1,126	6,255	0 5
Norwich	2,161	—	—	—	—	2,331	—	4,492	0 3
Nottingham	6,071	20,683	—	6,000	13,000	11,861	—	57,615	1 1 1/2
Nelson	—	4,154	655	—	—	—	—	4,809	0 9
Oldham	2,612	9,130	—	—	—	—	1,683	13,425	0 6 1/2
Oxford	1,673	—	5,715	—	—	4,950	1,143	13,481	0 9 1/2
Plymouth	945	—	3,576	—	—	3,731	—	8,252	0 4
Portsmouth	400	—	—	—	—	300	3,500	4,200	0 1 1/2
Preston	3,980	—	—	—	—	6,456	1,664	12,100	0 8
Reading	698	—	400	—	—	1,263	—	2,361	0 1 1/2
Rochdale	—	13,000	—	—	—	—	—	13,000	0 10
Rotherham	—	2,800	—	—	—	—	—	2,800	0 4
Salford	—	20,000	2,800	4,500	13,000	—	—	40,300	0 11 1/2
Southampton	253	—	—	—	—	412	4,662	5,327	0 2 1/2
Stafford	100	1,550	600	—	—	1,081	—	3,331	0 10 1/2
Stockport	—	11,200	—	—	—	375	1,675	13,250	0 8 1/2
Stockton-on-Tees	1,600	7,200	—	—	—	—	—	8,800	0 10
Sunderland	—	—	—	—	4,014	—	—	4,014	0 1 1/2
Southport	930	11,250	—	2,750	—	—	—	14,930	0 10 1/2
South Shields	134	—	—	300	204	888	240	1,766	0 1 1/2
St. Helens	1,357	5,000	—	—	—	—	—	6,357	0 8 1/2
Swansea	2,021	—	—	744	—	10,699	—	13,464	0 8
Stalybridge	44	1,650	—	—	—	—	57	1,751	0 4 1/2
Warrington	2,258	8,000	—	—	—	2,000	—	12,258	1 0 1/2
West Ham	—	—	—	8,000	—	—	—	8,000	0 12
West Hartlepool	494	—	—	—	30	—	100	624	0 0 1/2
West Bromwich	—	1,340	—	—	—	—	—	1,340	0 2
Wigan	1,500	13,000	—	—	3,595	—	—	18,095	1 6
Widnes	—	1,637	—	—	—	—	—	1,637	0 3 1/2
York	2,400	—	—	—	—	1,800	—	4,200	0 2 1/2

* Includes profits marked with same sign. || Public Lighting.

stant ratio between the population and the rateable value than is found in a list of American cities. The borough tax varies from 1½d in Newcastle to 3s 10½d in Wolverhampton. The poor tax and school tax are about equal which is a condition that would surprise taxpayers in this country. But six of the eighty-eight cities are without an assessment for free libraries.

The table is worthy of careful study and comparison.

Saving Trees from Brown-Tail Moth Pest

THE question of preserving shade trees from the depredations of caterpillars is being solved in Salem, Mass., by a plan originated by the *Evening News* of that city.

In April, 1902, \$80 in prizes were offered the school boys who destroyed the greatest number of brown-tail moth nests. The first prize was \$25; second, \$15; third, 10; fourth, \$5, and 25 prizes of \$1 each. The contest ran from April 3 to 16, in which time 36,002 nests were collected.

They were counted by the ladies of the women's clubs, and burned by the shade tree department. The contest of 1903 continued from March 30 to April 7, when 140,215 nests had been destroyed.

The city co-operated with the *News* in 1904, and the prizes were made: First, \$50; second, \$25; third, \$15; fourth, \$10; twenty-five \$2 and fifty \$1. The contest was from Feb. 20 to March 19, and resulted in the destruction of 374,193 nests, which is estimated was equal to the destruction of 149,677,000 caterpillars. The winner of the first prize collected 52,273 nests.

Indianapolis Discards Contract Street Cleaning

INDIANAPOLIS has gone into the municipal street sweeping business. Tired of dirty streets which the taxpayers have been paying to have cleaned for many years, under private contract, the administration under Mayor Holtzman, has finally made up its mind to do the work itself. With this end in view, a department of street sweeping has been organized with C. A. Garrard at its head.

A complete equipment has been bought, consisting of thirteen nine-foot wagon brooms, thirty dump-wagons, four sprinkling carts, 108 mules, and other necessities, costing about \$22,000. All of this outfit has been housed in one of the old street car barns, which was used during the days of the mule-car service. Municipal sweeping in Indianapolis begins on January 1, 1905.

Mayor Holtzman says that in undertaking to do the street sweeping through the Board of Public Works, his only fear is that an effort may be made to foist political hangers-on into jobs. He has given orders that no man is to be kept on account of a "pull," as

merit shall alone constitute the reason for keeping a man in the service. If the sweeping proves satisfactory, sprinkling will also be done by the city later in the season.

Indianapolis is spending \$75,000 a year for sweeping under private contract, which is appropriated by the City Council. It is believed that the city's equipment can be bought out of that appropriation this year and the work done with the remainder.

"London in Transformation"

NEW YORK must, for some years to come, yield to London the first place in population, and grant that it is even first in magnitude in the matter of expenditures for municipal improvements. An article by Randall Blackshaw, on "London in Transformation," in the current number of the *Century*, abounds in interesting and suggestive figures, and from which is taken the following paragraphs:

"London is being rebuilt as rapidly as New York; but it is so much vaster than the American city that the process is less conspicuous. Nothing is being done to-day that stands out so prominently as the great bridges over the East River; nor is there any analogue in London to the irruption of hotels and office buildings above the normal skyline in New York, the nearest approach to a 'skyscraper'—Queen Anne's Mansions, Westminster—varying in height from eleven to fourteen stories only.

"Of governmental projects perhaps the greatest is the buying out of the companies that supply London with water. Their claims amounted to about \$250,000,000, but radical cuts were made by the court of arbitration appointed to adjudicate them. It is unlikely that the Metropolitan Water Board will do as well, financially, as these eight companies, for the city's needs are growing with its population, while one of the chief sources of supply—the Thames—has been gradually dwindling for the last twenty years; so that it will be necessary to go far afield, before long, for a supply of water that can be depended on in times of drought. Next comes the proposed improvement of the port, and its control by a single body exercising the powers now divided between the Thames Conservancy and other authorities. The commerce of London has not grown as rapidly of late as the city itself. Lest it should continue to lose ground, a royal commission has reported the river channel must be widened to from 600 to 1,000 feet and deepened to thirty feet at low water. The estimated expense of this improvement is \$12,500,000; and new docks are recommended at a cost of about \$22,500,000.

"The principal public improvements of the last fifteen years have been due to the County Council, which superseded the Metropolitan Board of Works under the local government act of 1888. One of the least conspicuous but most costly of its single undertakings is the Blackwall Tunnel, which, when opened in 1897, had swallowed up \$7,000,000. The next undertaking of the sort (the tunnel from Rotherhithe to Ratcliffe) is expected to absorb nearly as much. The Tower Bridge, completed in 1894 at a cost of \$5,000,000—the most conspicuous of London bridges, the one farthest down stream, and the only one provided with a draw—was the work of the Corporation of the City of London; and the same body is now widening London Bridge, the most famous and still the most traveled of the many roads across the Thames. The cost is estimated at \$500,000. The corporation before long will probably lower the crown of the Southwark Bridge—a task which will virtually involve rebuilding, and is expected to swallow up \$1,750,000. The sway of the County Council begins somewhat farther up the river, where \$1,500,000 is being spent to replace Vauxhall Bridge with a structure of steel."

Municipal Playgrounds a Necessity

WHEN President Roosevelt was Police Commissioner of New York City he realized the importance of providing playgrounds for the children, and not only regarded it the duty of the city to provide such play grounds but believed such provision would reduce the petty offences of children, because it would afford the children a legitimate opportunity to work off the surplus energy and thus keep them out of mischief. In writing to Jacob Riis about the subject he said: "It is very important to the city to have a business man's mayor, but it is more important to have a working man's mayor. It is an excellent thing to have rapid transit, but it is a good deal more important, if you look at matters with a proper perspective, to have ample playgrounds in the poorer quarters of the city, and to take the children off the streets to prevent them from growing up toughs. In the same way it is an admirable thing to have clean streets; indeed, it is an essential thing to have them; but it would be a better thing to have our schools large enough to give ample accommodation to all should-be pupils, and to provide them with proper playgrounds."

What an Engineer Thinks of Bitulithic

CITY Engineer E. A. Kingsley, of Little Rock, Ark., has recently visited several cities in the South and West for the purpose of inspecting the various forms of pavements, in order that he might utilize his information in improving the streets of his own city. Among other cities visited were Indianapolis, Ind., and Shreveport, La. In the former city he had a conference with its former city engineer, Mr. Charles Carroll Brown, who is now editor of *Municipal Engineering*. Mr. Kingsley seemed to favor bitulithic, and in discussing its merits, Mr. Brown said: "Asphalt is sand and cementing material forming a plaster, while the bitulithic is a stone and a cementing material forming a concrete."

At Shreveport Mr. Kingsley was interviewed by a reporter from the *Times*, of that city, and when asked for his opinion about bitulithic as he had seen it in various cities, he replied:

"The advantage it has is that climatic conditions apparently have no effect upon it, whereas with asphalt it is entirely different. In all my observations I have never known of a single piece of bitulithic to disintegrate or to suffer any way whatever from the influence of the elements, or from any other natural cause."

In concluding his interview with the *Times*, he said: "During a recent trip to the World's Fair city, I discussed the two pavements (asphalt and bitulithic) freely, and inspected a great many pieces of them there, and from what I could learn, St. Louis asphalt streets, during the past summer, have held about as they are doing in other cities. They are rather expensive to maintain, and while they are noiseless, practically, when clean, I am coming to believe, that they are not such a success as they might be. While it is a beautiful street, and adds materially to any city, the cost of maintenance is probably more on an asphalt street than on any other class of modern pavement. I believe that the cost of maintenance will be less on a bitulithic street than on any asphalt street."

Disposal of Sheffield's Sewage

At a recent meeting of the Sheffield, Eng., city council a recommendation from the highway and sewerage committee was adopted that application be made to the local government board for its sanction of the borrowing of \$1,315,750 for the extension and improvement of the sewage disposal works of the corporation at Blackburn Meadows.

For several years the corporation has been engaged in studying the problem of sewage disposal. Not many years ago a lime process was adopted with the full consent of the local government board. A few years later experts in London discovered that the lime treatment was altogether wrong, and, although Sheffield had expended about \$243,325, the citizens were told that some other system would have to be adopted.

The local board, realizing that the disposal of the sewage of 400,000 inhabitants was an important question, has moved slowly in the matter. Recently, however, the West Riding rivers board has taken a hand in the proceedings and Sheffield particularly has been notified that the polluting of the river water by its sewage will be no longer permitted, and divers penalties are threatened if the practice is not stopped.

As the question of sewage disposal for a city the size of Sheffield is a difficult one to settle, the commission is not embarking on such a huge undertaking without carefully taking its bearings. For the past five years the city surveyor and his staff have been carrying on experiments at the sewage works.

The experimental stage may be said to have been passed, and sewage equal to that of a town of 30,000 inhabitants is being treated according to the system upon which it is proposed to expend \$1,315,750. Whether it is sufficient experts will have to decide, and there will shortly be in Sheffield a local government inquiry to determine this question.

Some five years ago Sheffield was confronted with several schemes; one dealt with treating the sewage on land near Workshop, another at Dorchester, each involving an expenditure of over \$2,433,250; a third contemplated carrying the sewage to the sea at a suggested cost of \$6,407,175, and a fourth considered the treatment by bacteria beds in the vicinity of the present works of the corporation, thus utilizing the existing land used for sewage disposal.

After elaborating on each process, it was the last named, the biological system, that the city surveyor suggested should be adopted by Sheffield. He continued the experiments, pointed out that the system was in its infancy, and advised against a hasty expenditure of money. Much progress has been made, the action of the bacteria beds have been carefully watched, and important innovations have been made to render the system efficient, with the result that an attempt is to be made to treat the whole of the sewage of the city by the biological process at an initial cost of over \$1,313,955, not including the price of a hundred acres of land which it is estimated will be required.

If the scheme is adopted the whole of the money will be expended at the sewage works. Three large main sewers will convey the sewage to the works, it will then pass through catch pits for the purpose of intercepting the grit,

which it is desirable to keep out of the beds, then into the sedimentation or settling tanks, and next into the contact or bacteria beds. The last named are made of coke or clinker, and the natural process that ensues in these beds is said to render the effluent pure, and it then runs into the river.

It is proposed to have sixty contact beds, each an acre in extent, and there will be fifteen settling tanks, each with a capacity of a million gallons. In addition there will be sixteen beds for dealing with storm water.

The river will have to be bridged in order to utilize the land, and a siphon will have to be fixed in the river. Roads and railways will have to be constructed, and in treating such vast quantities of sewage over so many acres of land the cost of the construction of conduits is no small item. The production of large quantities of sludge by the present lime precipitation has been a serious financial item; there would be none by the proposed scheme, which has been evolved after watching the experiments which have been carried on in Sheffield the last four years, and also the experience of other towns, Manchester having adopted a similar system at a cost of \$1,946,600.

In January last a report of a subcommittee recommended the adoption of a similar scheme at a total cost of \$1,787,635. This contemplated providing two contact or bacteria beds for the sewage after it left the settling tanks. A visit to Manchester showed that the city had the consent of the local government board to try the experiment of one contact bed instead of two, by promising to provide the second bed if the purification was found to be incomplete. Sheffield is able to proceed along similar lines, the corporation possessing sufficient land for second contact beds if they are considered necessary. As they were deemed unnecessary at Manchester, Sheffield has cut them out of the scheme, thereby reducing the estimate from \$1,787,635 to \$1,315,750.

Population of Transvaal Municipalities

THE most populous centers in the Transvaal are the Rand (Johannesburg and suburbs) and Pretoria, showing populations as follows:

The Rand (including Johannesburg, Boksburg, Germiston, and Krugersdorp), 260,388 persons, of whom 115,499 were white subjects, 1,171 officers and soldiers, 129,361 colored aborigines, and 14,357 colored, other than natives.

In Pretoria and suburbs there were (including Pretoria district) 164,468 persons, of whom 43,551 were whites, 74,710 aboriginal natives, and 46,207 colored, other than natives.

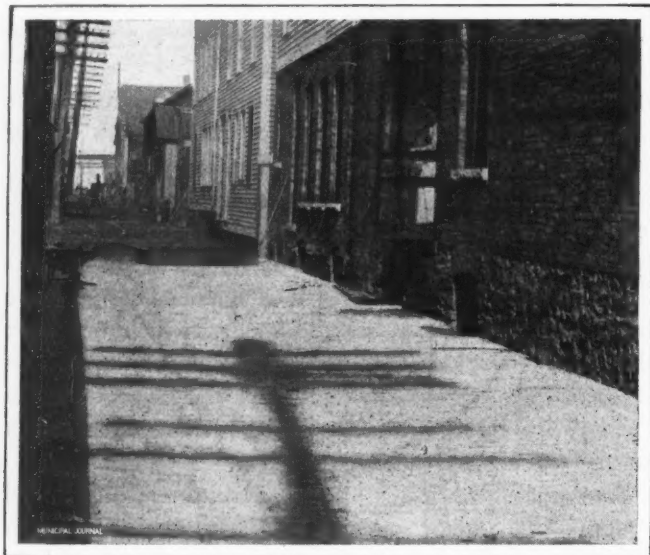
The white population of the principal towns was as follows: Barberton, 1,205; Ermelo, 767; Heidelberg, 1,838; Krugersdorp, 5,686; Lydenburg, 778; Middleburg, 2,395; Klerksdorp, 2,201; Potchefstroom, 6,021; Standerton, 2,015; Volksrust, 1,342; Pietersburg, 1,637.

The white population of the principal towns of the Orange River Colony is as follows: Bloemfontein, 11,429; Bethlehem, 1,023; Jagersfontein, 1,294; Koffyfontein, 1,329; Ficksburg, 1,011; Harrismith, 4,366; Kroonstadt, 3,723; Ladybrand, 2,333; Parys, 1,278; Winburg, 1,105.—

Consular Reports.

Brick Pavement at Niagara Falls

ACCORDING to the record of the City Engineer's office, Niagara Falls, N. Y., the brick pavements of that city have been constructed and maintained at a less expense than for asphalt for the same number of years. To be exact, the average cost of asphalt for a period of eighteen years was \$2.40 per square yard, and brick \$2.35.



AN ALLEY IN NIAGARA FALLS, N. Y., PAVED WITH BRICK MADE BY THE PITTSBURG-BUFFALO COMPANY

It is reported that asphalt, although fourteen miles of pavement are in use, is not as popular as it was, and the prediction is made that it will eventually be replaced by brick and bitulithic. There are two and a half miles of brick pavement in use in the city, which is reported in splendid condition. Good reports are made, also, of the bitulithic, of which over two miles has been laid.

The accompanying half tones show the brick pavement recently laid on two alleys. This pavement was laid on a Portland cement concrete foundation of four inches, which is the usual depth. The filler on the latter streets is tar, while in those first laid cement grout was used. The latter filler was used on the two alleys shown, and the cement grout mixture was in the proportion of one to one. The brick used on these streets was manufactured by the Pittsburg-Buffer Company, of Pittsburg, Pa.

Cost of Street Cleaning in Washington

ACCORDING to the annual report of Mr. Warren Stuttler, Superintendent of Street Cleaning, of Washington, D. C., during the past year 504,201,482 square yards of paved streets were cleaned by hand, as against 523,077,805 square yards in 1903, a decrease of 18,876,323 square yards, due to the transfer of a portion of the hand-cleaning area to machine sweeping last May. The total cost of this class of work, including salaries of repair and stable men, was \$88,057.72 in 1904, as against \$91,180.78 the previous year, a decrease of \$3,123.06, due to the lesser area cleaned. In May, 1904, the hand-cleaning area was reduced from 1,900,000 square yards to 1,600,000 square yards per day, and the daily machine-sweeping area increased from 1,400,000 square yards to 1,700,000 square yards. At the

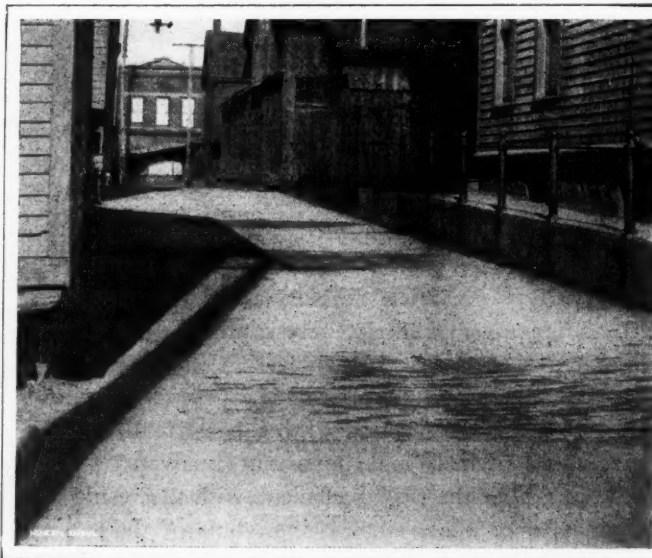
same time the number of laborers on hand cleaning was reduced from 202 to 160, because of the lesser area to be cared for.

Previous to November, 1903, the horses of the department were boarded at a livery stable at a cost of \$16 per head per month. In October, 1903, the commissioners leased half of the two-story brick building in which the horses were kept, at a rental of \$70 per month, and in the following November they leased the whole building at a monthly rental of \$125. This department took full charge of it, and the repair shop and storage room, which had previously been located in another section of the city, were transferred to that point, thus placing under one roof that branch of the service pertaining to the maintenance of the equipment used in connection with hand cleaning and sprinkling. By reason of this arrangement a considerable saving in the cost of maintaining the horses was effected as the forage was purchased at contract prices, thus eliminating the profit accruing to the livery man under the old system.

The contract rate for machine sweeping in 1903 was 18 cents per 1,000 square yards. In June of that year a new three-year contract for cleaning paved streets and avenues by machine sweeping or flushing, the area by the latter method to approximate 25,000,000 square yards per annum, was entered into at 16 13-16 cents per 1,000 square yards.

During 1904 there was cleaned by machine 269,925,809 square yards of paved streets, as against 232,386,728 square yards the previous year, an increase of 37,539,081 square yards, due to the transfer of a portion of the hand-cleaning area to machine sweeping last May. The cost of this class of work during the past year was \$45,381.26, as against \$41,829.62 in 1903, an increase of \$3,551.64, due to the greater area cleaned.

By means of hose attached to the fire hydrants about 60,000 square yards per night of paved streets were flushed.



AN ALLEY IN NIAGARA FALLS, N. Y., PAVED WITH BRICK MADE BY THE PITTSBURG-BUFFALO COMPANY

during three months in the summer of 1903. Owing to the low water pressure, however, the experiment was not entirely a success. In June of the present year an eight-hour test of a flushing wagon was made, but the representative

of the manufacturing company claimed that the pressure at the fire plugs was insufficient for his machines to do proper work.

Since the close of the fiscal year the superintendent of the street-cleaning department has been under investigation upon charges preferred by a former contractor. The commissioners have the case under advisement.

Benefits of Wide Tires

THE team owners of Chicago have organized to oppose the "Wide Tire" ordinance of the city, which is to become effective Jan. 1, 1906. In a pamphlet issued by the association it is asserted that compliance with the ordinance would increase the wear and tear on the streets, because from the pitch of the wheel and axle the tire would bear on its outer edge instead of bearing on its entire surface; that increasing the width of the tire increases the tractive effort necessary to move a load, and that three horses would be required to do the work that is now done by two; that the increase in the width of the tire increases the obstructions over which the load must be lifted, thereby increasing the bumping wear on the streets; that the increase in the weight of the wagon would necessitate a decrease in the weight of the load from one-sixth to one-fourth, and a corresponding increase in the cost of cartage; and, final objection is made against the cost involved in making the change.

Alderman Henry F. Eidmann, one of the strongest supporters of the ordinance, says, in reply, that in drafting the law the experience of all places having such laws was considered; Philadelphia, Des Moines, Paris, Berlin, the various countries of Europe, and the States of Iowa, Rhode Island, Missouri and Utah. That practical tests prove that less tractive effort is required with a wide tire than with one of standard width, the figures being for a total load of 4,900 pounds a wagon in soft dirt with tires one and one-half inches wide, required 663½ units of power to haul; with three-inch tires 473 units, and with four-inch tires 461 units; that a wagon of 3,000 pounds' weight is made not over 150 pounds heavier by wide tires; that wide tires roll obstructions smooth and prevent sinking into the street surface; that as large or larger loads would be hauled by the same power, and the expense of cartage would not be increased; and, that the team owners who now ruin from \$4,000,000 to \$5,000,000 of pavement annually should not begrudge a small outlay to relieve the taxpayers.

The Chicago ordinance has been carefully drawn with reference to the contour of the streets, and the regulations governing the width of tires, are as follows:

"1,000 to 2,000 pounds, including weight of wagon, 1-inch tire.

"2,000 to 3,000 pounds, including weight of wagon, 1½-inch tire.

"3,000 to 4,000 pounds, including weight of wagon, 2-inch tire.

"4,000 to 5,000 pounds, including weight of wagon, 2½-inch tire.

"5,000 to 6,000 pounds, including weight of wagon, 3-inch tire.

"6,000 to 7,000 pounds, including weight of wagon, 3½-inch tire.

"7,000 to 8,000 pounds, including weight of wagon, 4-inch tire.

"8,000 to 9,000 pounds, including weight of wagon, 4½-inch tire.

"9,000 to 10,000 pounds, including weight of wagon, 5-inch tire.

"10,000 to 11,000 pounds, including weight of wagon, 5½-inch tire.

"11,000 to 12,000 pounds, including weight of wagon, 6-inch tire.

"12,000 to 14,000 pounds, including weight of wagon, 6½-inch tire.

"14,000 to 16,000 pounds, including weight of wagon, 7-inch tire.

"16,000 to 18,000 pounds, including weight of wagon, 7½-inch tire.

"18,000 to 20,000 pounds, including weight of wagon, 8-inch tire.

"Penalty: A fine of \$10 to \$50 for each offense each day."

Municipalities Responsible for Defects in Public Structures

THE Supreme Court of Minnesota held, in the recent case of McDonald vs. City of Duluth, that where there are obstacles to overcome in the construction of any public work, and reasonable minds might differ as to whether the plan adopted therefor by the municipality was the best and safest one, the decision of the municipality on the question cannot be reviewed by the courts, but that a municipality is liable for an injury caused by an unsafe public structure, although the defect exists in the plan adopted for its construction, if there be no reasonable necessity for having the defect, and that where such a structure is unsafe by reason of its negligent construction and the defects are not latent, it is not necessary to show that the municipality had notice of such unsafe condition in order to recover for injuries sustained thereby.

Water Meters in Fort Worth

CITY ENGINEER JOHN B. HAWLEY, of Fort Worth, Tex., recently had this to say about the use of water meters in his city:

"That every consumer, public or private, in this city gets his water through a meter, and pays for what he gets at rates not exceeding 20 cents per 1,000 gallons, rates for large consumers running as low as 10 cents per 1,000. In spite of the general opposition of the public to the meter system when the matter was under discussion by the City Council, it has been many months since I have heard a single complaint or criticism.

"I think I am putting it mildly when I say that more than 99 per cent. of our consumers would oppose a return to the old flat rate system. It was urged by the opponents of the meter system that our revenues would be ruined if meters were installed. The exact opposite happened.

"Our revenues are much larger and pumpage much smaller than before meters were put in. It was also urged that people would be so careful, stingy in fact, in their use of water, that flowers would die, lawns get brown, etc., but that allegation has also proved false, as both are in as good or better condition than formerly.

"You will pardon me if I interpose a personal matter, illustrative of cost of water under the two systems.

"Up to the time the meters were installed, my flat rate was \$34 a year. Under the meter system I paid \$24.40 last year, and my lawn needs more water than it used to, and gets it.

"Reverting to items of consumption and revenue, I have just received the following data from Hon. H. L. Calhoun, acting superintendent of waterworks:

"In 1896 we had 2,000 consumers. We pumped an average of 3,600,000 gallons per day. Our cash receipts were \$54,000.

"In 1904 we have more than 5,000 consumers. We average 2,000,000 gallons pumpage per day, and our cash receipts are \$70,000 per year.

"In addition to the above statements, I want to say that the meter system has practically solved the water problem for this city, and has done away with the \$40,000 to \$50,000 burden which the people used to carry in their payments to vendors of artesian water.

"For more than a year nothing but pure artesian water has been pumped to consumers, and the seller of artesian water by the barrel is out of business.

"I am at a loss to know why there should be any opposition to the use of meters when such results as these always follow their installation."

Street Railways Compelled to Issue Transfers

THE New York Court of Appeals has recently decided that where a street railway owns or operates two or more lines, it is compelled to issue transfers from one line to another. The railway companies, in the two cases that were tried, sought to have the transfer rights of passengers restricted, but the Court handed down the above decision. The Court ruled, however, that only one penalty should be recovered in a single action, and that the institution of an action for a penalty is to be regarded as a waiver of all previous penalties incurred.

How to Collect Local Assessments

A NEW PLAN for the collection of assessments for local improvements has been outlined by Councilman Snyder, of Spokane.

At present delinquent assessments are foreclosed by judicial proceedings, whereby the city obtains a decree in the amount of the assessment or instalment, and an order for the sale of the land. This method is expensive, entailing as it does counsel fees and court costs.

The plan proposed is the same as that for enforcing the collection of delinquent taxes, and embraces the issuance and sale of delinquent assessment certificates, the validity

of which are guaranteed, and to bear interest at a rate not to exceed 15 per cent. per annum.

It is claimed that by this method the city would receive promptly the amount of an assessment in cash; and by virtue of the guarantee of the validity of the assessment the investment would be attractive to capital. The rate of interest, viz., 15 per cent., and the fact that assessments or instalments are for comparatively small amounts, would make it a popular as well as a profitable investment; and the city by receiving each assessment or instalment promptly, as it becomes due, would be able to secure better bids from contractors than it can when they must take into consideration the probability that a certain percentage of the assessments will not be paid.

Municipal Dentistry in Germany

The dental statistics gathered in many European cities have revealed such an alarming condition of affairs that Germany, at least, has decided to adopt combative measures.

In all large towns dental clinics have been founded, consisting, as a rule, of specially fitted-up rooms in one of the central schools.

Fully qualified dentists are appointed, who devote their whole time to their duties, but in Stuttgart the work is done voluntarily by the local dentists. That such a movement is necessary can scarcely be doubted when one learns that of many thousands of boys and girls examined, from the ages of 8 to 13, only 2 per cent. had a perfectly healthy set of teeth. To give an idea of the amount of work done in a year at Darmstadt schools it is necessary to quote the figures for 1903. During the year 1,376 children were examined, and 1,561 teeth were filled, while 1,871 were extracted. In Strassburg, 2,666 children were examined, 699 teeth were filled, and 2,912 were extracted.

Another interesting fact is that 40 per cent. of all teeth examined were bad. The method of work is very simple; the teacher brings his class to the dentist, who examines each mouth quickly and marks on the card which each child has brought with it whether treatment is necessary. If so, the child must come again on a Saturday. Russia is also joining in the movement, and has already fitted up nine such institutions in St. Petersburg alone, while Moscow has also several.

Memphis Water Works Make Money

IN a statement issued by the members of the Memphis Board of Water Commissioners, a comparison is made between the earnings and operating expenses of the city water works under a private company in the years 1902-03, and under municipal direction in the following year, 1903-04. The summary is as follows:

	1903-4.	1902-3.
Gross earnings	\$367,961.82	\$330,067.09
Operating expenses	321,399.46	284,623.60
Less charges for interest, sinking fund and taxes	167,549.72	102,974.16
Net operating expenses	\$153,849.74	\$181,649.44
Net earnings	\$214,112.08	\$148,417.65
Increase	65,694.43	

INCIDENTAL ITEMS OF INTEREST

Many Matters of Moment to Municipalities Briefly Told—Short Record of Happenings and Facts in City, Town and Village

* * * An entering wedge has been driven for doing away with the anti-smoke ordinance in St. Paul. On the plea that property owners should not be subject to penalty from smoking chimneys when fires are first started under boilers, the ordinance has been amended to permit chimneys to smoke for a half hour at a time, which, it is claimed, will nullify the entire law. The law has worked well heretofore, and no effort has been made under its provisions for prosecuting property owners for unavoidable infringements.

* * * St. Louis is considering a bond issue of \$9,000,000 of which \$2,000,000 will be appropriated for improving and extending the sewerage system, and \$1,000,000 for an insane asylum; \$2,475,000 police headquarters, jails and courts; \$230,000 for fire department. King's Highway boulevard is to be improved at an expense of \$2,000,000 with the intention of making it one of the finest thoroughfares in America, and \$500,000 will be expended on parks.

* * * Westmount, Canada, is to have a municipal light-and incinerator plant as a result of what was deemed excessively high rates charged by the Montreal Light, Heat and Power Company.

* * * Mayor Sweet of Grand Rapids has issued a proclamation warning the people to boil the water used for drinking purposes as a prevention against typhoid fever. Last year twenty-three cases were reported during December, and the number increased during the winter to ninety-one cases in March. During the first fourteen days of the present December fifty-two cases have been reported, which would, in the same proportion, mean more than 400 cases by next March. The investigation that resulted in this proclamation showed that but one family in seven was boiling its drinking water.

* * * The people of Topeka, Kan., are discussing whether the municipal water works system should be under control of a board created by the City Council, or commissioners independent of politics.

* * * The amounts and kinds of pavement in Cleveland, O., at the close of March 1, 1904, were: Asphalt, 17.4 miles; Medina stone, 87.2 miles; brick, 117.7 miles; wood, 0.3 miles; and macadam, (cinder and stone) 0.7 miles, making a total of 223.3 miles.

* * * A new "Isle of Safety" for people desiring to board surface cars in the congested districts is building in San Francisco. This will be the third in use, which equals New York's record.

* * * The city of East Orange, N. J., has successfully gone into farming. Hay, oats and bedding sufficient to supply the needs of the several public stables have been raised on city land during the season. The value of the produce exceeds that of the expenditure by \$2,500.

* * * Ohio cities are moving against the grade crossing. Cleveland has made important advances in the matter of their abolition, Columbus is investigating and Youngstown is demanding investigation.

* * * Mayor, *pro tem.*, T. D. Longino, of Atlanta, recommends a municipal laundry and wood-yard. The city claims to give \$60,000 more than any other city of its population to charity, and without competing with private industry, applicants for relief could be provided with work and the city would be saved large items in the running expenses of the public institutions.

* * * The inspectors of gas meters in London, England, discovered only thirty-two incorrect indices during the past year. It was possible, however, to examine only those for ten lights and upwards and those which were disputed. The total number tested was 200,000, of which 86,000 were prepayment or slot meters. Though the amount of error found in each case was large, ranging from 50 per cent. in favor of the consumer to 150 per cent. in favor of the company, the small number of inaccurate meters found proves that reasonable precaution is taken by the manufacturers to have them register correctly.

* * * Knoxville, Tenn., has placed cocaine, opium and morphine on the *index prohibitorum*, and hereafter these drugs are only to be dispensed for medical purposes on a physician's prescription.

* * * During the past fiscal year twelve miles of cement walks have been laid in Washington, D. C., the price paid for laying being \$1 and \$1.15 per square yard, which, for the present year, will be reduced to 96 cents and \$1.06. They are laid under both the permit and the assessment systems, the city bearing one-half the cost in either case.

* * * It is proposed to stipulate in the deeds to certain small parcels of land to be sold by the city of Baltimore in the burnt district that the property shall not be used for bill-boards or other advertising purposes.

* * * Mayor Johnson, of Cleveland, O., has signed the ordinance increasing the salaries of the city councilmen from \$600 to \$1,200 a year.

* * * Water rates for charitable institutions in Chelsea, Mass., are assessed on the same basis as for other consumers.

* * * The annual report of the Board of Public Works of Geneva, N. Y., shows 5,384.1 feet of streets paved during the year, of which 3,742.1 were of Corning brick at a rate ranging from \$2.031 to \$3.011 per foot frontage; 642 feet were of tar macadam at \$1.339 per foot, and 1,000 feet of Dresden macadam at from \$1.53 to \$2.059 per foot. The total cost of street improvements for the year has been \$38,891.95, and 40 per cent. of the city streets are now paved.

* * * The Water Works Department in Cleveland, O., employs regularly a force of 240 men. The superintendent receives \$3,500 salary and the first assistant engineer \$3,000; two other engineers \$2,200 and one \$2,000; thirty-one employees are paid from \$1,000 to \$1,800 each, and of those remaining all except the telephone operator and janitors are paid over \$500.

FIRE FIGHTING SYSTEMS*

An Australia Fireman's Conclusions After Inspecting the Fire Departments of Forty-five Cities of America and Europe

The result of the observations of a practical fireman and a keen observer after investigating the workings of the fire departments of many cities on the Continent and in America, cannot fail to prove of interest and service to fire fighters everywhere. Here are some of the conclusions drawn by this observer:

BUILDING REGULATIONS

On the Continent of Europe, building regulations are most stringent, and are more strictly enforced than in any other part of the world. The height for buildings, a considerable factor in fire extinguishing, rarely exceeds 70 ft., measured from pavement to parapet. There are many buildings of large cubical capacity, but they are invariably divided by brick walls and fire-resisting doors, so that in no one part is the measurement excessive. The fire preventive measures undoubtedly account in some degree for the general immunity from large fires. The Building Acts of London, of recent years, have undergone considerable alterations. Many clauses especially deal with the prevention of the spread of fire, and the saving of life. It is hoped that in any Building Act introduced here similar clauses will be included.

A perusal of the building codes of most cities in America shows that danger from fire is most acutely recognized; but, so far as my information goes, only one city—Denver—prohibits the erection of wooden buildings of any description. Statisticians say that 93 per cent. of the buildings in San Francisco are of wood. Strangely enough it is one of the towns of America where very large fires are most infrequent. Greater New York, with its immense alien population, experiences more large fires, per head of the population, than, perhaps, any town except Chicago. In the opinion of many, the height of a building should not exceed 80 ft., measured from the pavement to the parapet or eaves of the main roof.

In Great Britain and on the Continent of Europe the number of fires per head of the population does not differ very materially from the proportion in Sydney; but throughout America the fires, as compared with Sydney, average four to one.

WATER SUPPLY

This and the facilities of obtaining access to it are the main features of successful fire fighting. The water supply of London for many years was totally inadequate for the requirement of the firemen, but of late considerable improvements have been effected in the service, and there is every prospect of the supply proving ample for the needs of the brigades. Throughout the Continent and America all water used for extinguishing fires is supplied free.

* Superintendent Webb, of the Sydney, N. S. W., Australia, Metropolitan Fire Brigade, who lately returned from a trip round the world, has presented his report to the Board. He visited no less than 45 of the principal towns on the Continent and America, and at each place he thoroughly investigated the working of the Fire Brigades and their method of administration. The principal features of his report appear in this article.—[Editor.]

The municipalities in America almost without exception, own the local waterworks, and great attention is paid to supplies for fire extinguishing. Especial features are made of large pipes and post hydrants. These latter, being above ground, are quickly discernible even in the darkest night, and make for success in fighting fires. It would be of great advantage to firemen in Sydney if post hydrants were introduced, and placed as near the corners of streets as possible, commencing with the business section of the city.

For a number of years the municipalities of the United States have recognized the danger of the ordinary water supplies failing during the continuance of a fire, and, where rivers or other large quantities of water were available, have laid large pipes through portions of the cities for fire purposes only. At the water side, powerful floating fire engines are connected to these pipes, and force water through them, for the supply of land engines. It is contended that steam fire engines will not be required for the districts covered by these pipes, and that the first outlay, though large, will be fully compensated by the saving effected in the maintenance, in the quicker extinction of fire, and in doing away with the necessity for expensive movable engines.

FIRE ENGINES

The small steam fire engines of a few years ago are being superseded by others capable of delivering larger quantities of water. Every fire engine maker is endeavoring to manufacture an engine which will deliver the largest possible quantity of water per pound weight of the engine. The weights of engines, per gallon of water delivered, in Great Britain and Europe, do not materially differ. In America fire engines are heavier, in proportion to their delivering capacity, than those in Europe. Therefore, in 99 per cent. of the fires at which these engines work, much unnecessary weight is carried, necessitating the use of additional horses, and, of course, adding very materially to the expense of the departments.

SELF-PROPELLING STEAM FIRE ENGINES.

For a number of years, with more or less success, endeavors have been made to construct self-propelling steam fire engines which will fill fire brigade requirements. The London Brigade has been experimenting, several of the provincial towns in Great Britain have recently made purchases, Boston (U.S.A.) has at least two, and they are being tried in Germany. The cost of the upkeep of these engines is too high for the benefits resulting from their use, and I gathered that the experience of six years at Boston did not present such satisfaction with self-propelling steam engines as to induce the purchase of others.

LADDERS

The ladders used on the Continent are better in every respect than those in use in Great Britain. The material and the work in the British ladder is everything that could be desired, but the mechanism of the German makes is superior to that of American or British designs. Absolutely

the most reliable ladder which came under my notice was that known as the "lattice girder ladder." This, with the German mechanism for working it, is the best and most reliable for general work at fires.

CHEMICAL FIRE EXTINGUISHERS

Much attention was paid to the inspection of these engines, with a view to ascertain which were to be preferred for adoption here. The most serviceable type of chemical engine inspected was the 60 gallons carbonic acid gas extinguisher. The apparatus is very simple in construction, and is easily charged.

FLOATING FIRE ENGINES

At New York, Chicago, and Buffalo, are powerful fire boats such as would be eminently suitable for Sydney. The largest has a delivering capacity of 12,000 gallons (American) a minute, while the largest nozzle has a diameter of 6 in. Sufficient steam is kept on the boilers to enable the vessels to start promptly, and they are despatched to all fires near the water side to which the brigades may be called. It is represented that, with the extensive water frontage which Sydney and the suburbs possess, a floating fire engine would be invaluable to the fire department, especially in view of the large timber yards round the foreshores.

MEN

Most of the towns in Great Britain insist on firemen passing a severe medical and measurement test. In America the applicants must pass an educational and medical test, but there appears to be no standard of measurement. The method of training firemen in Sydney could with advantage be adopted in much older fire brigades. I can confidently affirm that in no town is the instruction of the men so thorough.

RECOMMENDATIONS FOR AN AMENDED FIRE BRIGADES' ACT.

In order to avoid the mistakes of the Old World in minimising the usefulness of a fire brigade, it is recommended that the fire brigades of this State be placed directly under the Government. Taxation should be distributed as equally as possible, but it is not so with regard to fire brigade maintenance in New South Wales. To place fire brigades in this State under municipal control would add to the burden of ratepayers, and the system of fire brigade government by municipal authority is not satisfactory. In London during the last few years of the Metropolitan Board of Works this was especially noticeable. Moreover, greater efficiency, greater uniformity of method, and greater economy in the distribution of fire extinguishing appliances and the general administration of funds, could be attained by placing the fire brigade forces under the State Government. For the protection of the country towns of New South Wales it is strongly urged that a system of partially-paid volunteer fire brigades be adopted. In the suburbs of Sydney where this has been done the success of the movement has been most marked and the system would form a model for similar organizations in the country. The present system of volunteer fire brigades in the country is too unreliable.

RECOMMENDATIONS

For the protection of Sydney and the suburbs, known as the "Metropolitan District," the following recommendations

are submitted: 1. That the district under the jurisdiction of the Fire Brigades' Board be divided into seven parts (instead of five), to be as equally divided as the contour of the country will allow, each division to be in charge of a district officer. 2. That the Deputy Superintendent be placed in charge of four districts, and the Senior District Officer in charge of three. 3. That every station be under the command of a Station Officer. 4. That the number of officers at headquarters be reduced to three. 5. That the rank of "Assistant Officer" be abolished. 6. That the position of "Principal Electrician" be created, with special hours of duty (fires excepted) and a special rate of pay. 7. That the position of "Principal Mechanic" be created, with special hours of duty (fires excepted) and a special rate of pay. 8. That a pension fund be established. 9. That the fire alarm system be improved, and all wires converted to metallic circuits. 10. That immediate increases be made in the number of fire stations and men. 11. That small stations be established about the city and immediate suburbs each to accommodate a first-aid self-propelling wagon. 12. That one or more floating fire engines be obtained for the protection of waterside property. 13. That self-propelling fire engines, hose carriages and first-aid appliances, be obtained as quickly as possible. 14. That additional self-supporting fire ladders and fire escapes be obtained. 15. That the Board of Water Supply and Sewerage be invited to put down a number of post hydrants in the business portions of the city as near as practicable to the corners of streets. 16. That the Government be invited to pass special regulations providing for the erection of outside fire escapes and balconies on all buildings over 60 feet in height. 17. That the Government be invited to pass special regulations restricting the height of buildings to 90 feet. 18. That the Government be invited to issue special regulations for the protection of the public in all buildings used for public concourse.

Pensions in Washington Fire Department

WITH reference to pensions Fire Chief Belt, of the District of Columbia, says

"There are now forty-six pensioners on the rolls of the department, whose pensions range from \$10 to \$100 per month. There is, however, but one who receives \$100, an ex-chief engineer. Members of this department, with the exception of the chief engineer, are all pensioned alike. The officers receive the same pension as is paid a private, regardless of their rank and service. This, it is respectfully submitted, should not be. The police department, which receives pensions from the same fund, distinguishes between its members in matter of the amount of pension according to the rank of man retired. But not so in this department. A foreman, who has served the department for years, is entitled, under the existing regulations, to no more consideration than the private who may after a few years' service become disabled in the line of duty. The work of a fireman is indeed as important as that of a policeman, the hours assigned to him are a great deal longer and he faces danger twice as often, and it is earnestly recommended that some regulation be adopted to increase the pensions of the department's officers."

The Royal Fire Company at York

ONE of the handsomest and most completely equipped fire houses in the country is that of the Royal Fire Company, No. 6, of York, Pa.

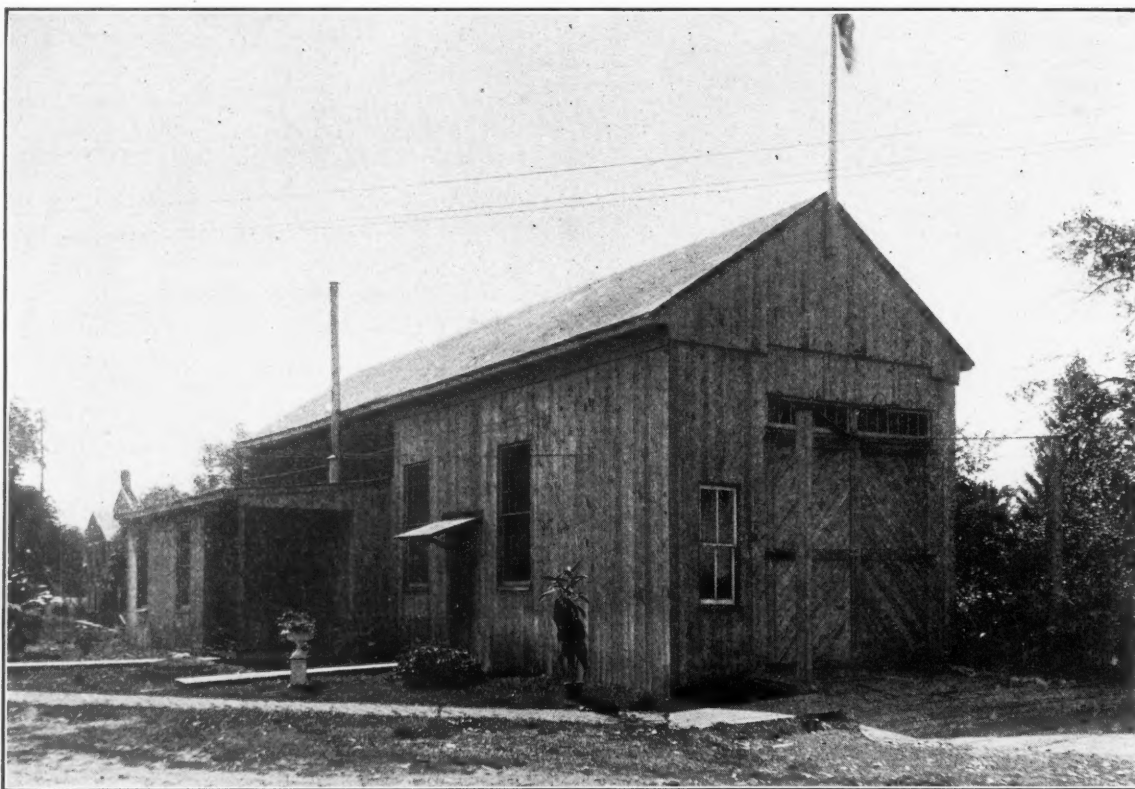
It is located in the western section of the city, which was without fire protection at the time of the organization of the company, in 1901, and its existence had become a necessity from the rapid growth and development of this industrial portion of the town.

The organization of the company was undertaken by several gentlemen of influence and wealth. Among whom Congressman D. F. Lafean, John F. Young and Hiram M. Faust may be mentioned as specially active, and was incorporated under the State law. A site for the fire house was purchased and a temporary building erected where was housed a second-hand exercise wagon, two horses, two

Before the engine could be officially tested, one of the most disastrous fires—one in which three firemen of another company were killed by falling walls—in the history of the city occurred, and the machine was called into service for a practical trial, which proved exceptionally satisfactory.

Of other equipment the company owns an emergency wagon, specially built by the Martin Carriage Works, 1,900 feet of hose, and 167 uniforms, all new, of the regulation New York style.

The instructions to the architects of the proposed building were to design a house that should embody the best and most approved features in Fire Engine Houses, as demonstrated by the experience of other cities. With this end in view Messrs. Hamme & Leber, the architects, investigated the plans and practical working qualities of



THE FIRST BUILDING OF ROYAL FIRE COMPANY, NO. 6, YORK, PA.

portable chemical fire extinguishers, and the hose that was procured subsequently.

The first run and duty was at a small fire, on January 29, 1902, which was easily extinguished. In February following the company purchased a combined chemical engine and hose wagon of the latest improved Holloway type and became a part of the York Fire Department, with John F. Young as its representative as assistant chief of the department.

It purchased, early in 1904, of the Manchester Locomotive Works of Manchester, N. H., a first size Amoskeag steam fire engine at a cost of \$6,200. This is a beautifully finished machine, equipped with rubber tires and roller bearing axles, with all the latest improvements and full nickle trimmings. It weighs 9,850 pounds and has a capacity of 900 gallons per minute. The harness is Berry's patent with appliances for quick hitching.

houses in the larger cities with the result that the Royal's is one of the most perfect in arrangement and construction, as well as one of the most beautiful, in the country.

The building is "L" shaped, with a street frontage of 43 feet, and a depth of 106 feet, the width of the wing being 69 feet. The materials used in construction are red Pompeian brick and Hummelstown brownstone laid in brown mortar, with slate roof and copper gutters, valleys and downspouts. The main building is two stories in height, which equal three stories in the wing, and there is a tower 100 feet high, with hanging space for drying 2,500 feet of hose at one time.

Two double-door entrances, and a smaller one, open from the street into the apparatus room, which is 40 x 80 feet, and contains the engine, chemical engine and hose wagon and a hook and ladder truck. The ceiling of this room is 17 feet high, the side walls being wainscoted with tile to a

height of five feet with a base of Tennessee marble. The floor is of sheet asphalt.

In this room stands the marble electric switchboard, which is a marvel in its completeness and ingenuity. It is over 6 feet high from the floor to the flat top, and each of the panels, which are of Italian marble, is $4\frac{1}{2}$ feet wide. These panels contain large gongs for striking the fire alarm, with automatic calls for recording the time the company has been out to service. There are also automatic devices for releasing all stall doors, for turning up electric lights, for telephone connection for each of the two city telephone companies. And there are speaking tubes for talking to different parts of the building, push buttons for restoring numbers and lights and automatic cut-

into the members' reading room, which is most convenient.

The reading room is 21 x 21, with one end octagonal and lighted by five large windows. The wood work is natural Virginia oak and the papering a dark red, making a handsome combination. The toilet room adjoins.

The broad and easy stairway leads from the main hall with its panelled wainscoting, to the uniform room, which is 18 x 20, and perfectly equipped with closets and lockers. Continuing up the stairway, on the floor of the mezzanine story, is the billiard room, lighted by large windows and finished in forest green with white pine trimmings.

On the second floor is the magnificent meeting room, 40 x 40, and with ceiling 16 feet high, and the parlor, which is a remarkably handsome room. Both of these



NEW BUILDING OF ROYAL FIRE COMPANY NO. 6, YORK, PA.

outs and fuses for protecting the outfit from harm. It is, without doubt, the finest and most complete engine house gong case in existence, and was installed by the Gamewell Fire Alarm Telegraph Company.

Back of the apparatus room is the stable, 22 x 55 feet, and containing eight single and one box stalls. The inside walls are of buff brick with a wainscoting in light brown. The ceiling is heavily beamed and panelled, the wood work being of red oak. The feed and harness rooms and water fountain are conveniently located.

Connecting with the stable is the work room, 20 feet square, for the repair of apparatus and harness. And from this room the stairway leads to the dormitory, employees' rooms and uniform room.

The main entrance is covered by a handsome porch and floored in mosaic. It opens into the main hall, which leads to the grand staircase in the tower. From this hall a plate glass door opens into the apparatus room, and another door

rooms are oak trimmed, and have polished hardwood floors.

Back of the parlor is the dormitory, trimmed in white pine and finished in white enamel. The walls are papered in green and the floors are covered with green velvet rugs. It is well lighted and contains six brass bedsteads with the other necessary furniture, and is connected with the apparatus room by sliding poles. The dressing room, bath room and linen closets adjoin.

The building is heated throughout by the vapor system. "The object sought," said the committee in its report, "was to get a plant of the most thorough working efficiency, recognizing the fact that minutes gained in getting to a fire are thousands saved on property in danger. Working on these lines they have produced a building which they believe completely fulfils these conditions, and they submit the result to the judgment of all, believing that an intelligent and discriminating public will approve their course and work."

Pittsburg Resents Underwriters' Report.

CITIZENS of Pittsburg, Pa., resent with some indignation a recent report of the National Board of Fire Underwriters, which is condemnatory of Pittsburg's conditions. General Sewell, the War Department expert, expressed the opinion that the city was menaced by a conflagration which might equal Baltimore's big fire. The Pittsburgers admit that the building laws are open to improvement, but praise the fire and water departments for their efficiency.

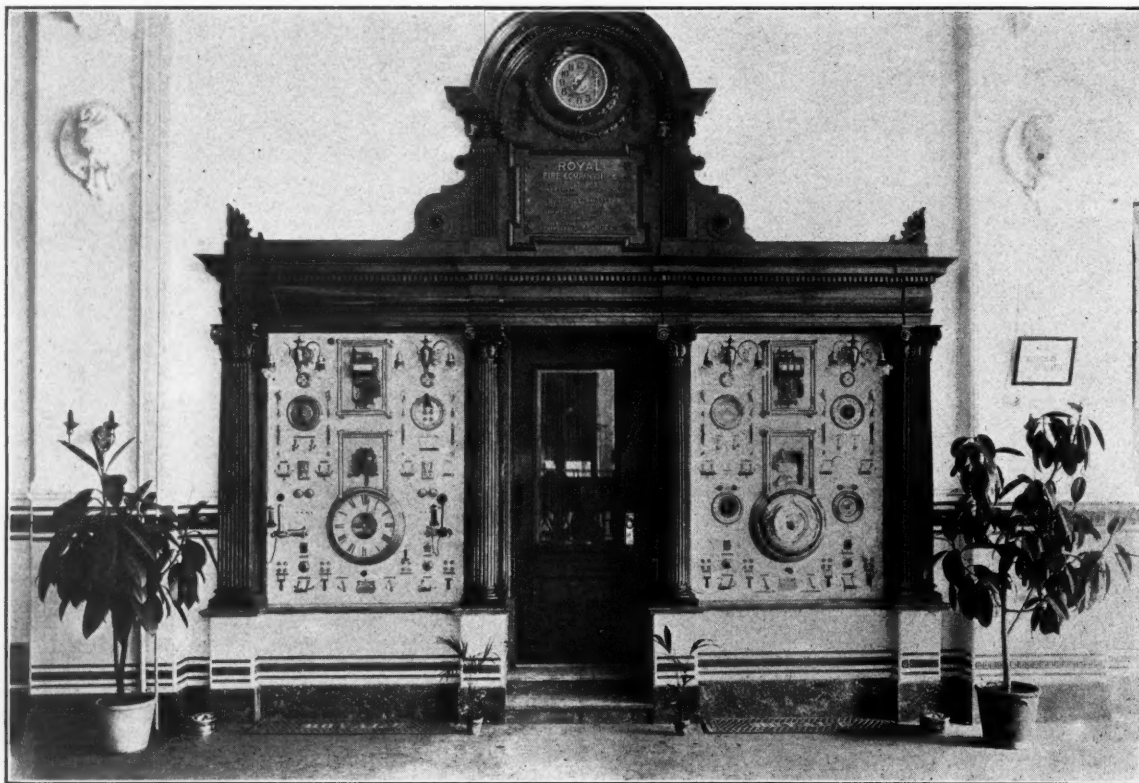
The fact that unusually large quantities of explosives are permitted to be stored in downtown buildings was heretofore not generally known, and those who first had the matter brought to their attention through the report condemn the authorities. That the fire marshal has not long since started active warfare against such a condition calls forth surprise. That the city of Pittsburg has additional fire hazards by rea-

main runs along Liberty street to Water street, and up Water street to Grant street. A 36-inch main runs along Duquesne way to Third street, and up Liberty street to Second avenue, intersecting at Smithfield street with the other 30-inch main, and going on to Grant street. Smaller mains have been laid from each of these 30-inch mains until the entire downtown district is a web of effective mains."

Major G. W. Hammer, secretary of the Allemania Fire Insurance Company, who has been in the fire-insurance business here for 30 years said:

"The men who made that report to the National Board of Fire Underwriters are competent and experienced and knew what they were talking about. Conditions locally are bad, but not as much so as before the fireproof buildings were built.

"The trouble can be traced mainly to three sources—the



SWITCHBOARD AND GONG CASE, ROYAL FIRE COMPANY NO. 6, YORK, PA.—MADE BY THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY, NEW YORK

son of the fact that but little attention is paid to the matter of electrical wiring of buildings in a manner not in accordance with well-prescribed rules, is also troubling those to whose attention the matter has been brought.

William L. Jones, a member of the local board of fire underwriters, condemned the report, saying he considered it entirely unwarranted and not in accordance with the findings of the officials and engineers who conducted the investigation.

"We have no conflagration hazards," said he, "such as are in evidence in other cities the size of Pittsburg. It is true that there are many dangerous spots upon the Southside, but to condemn Pittsburg as a whole is entirely unwarranted. In the last two years the city of Pittsburg has installed a 30-inch water main, fed from a 50-inch main running parallel with the Butler street main, and which narrows down to 30 inches at Twelfth street. This 30-inch

fire marshal, the building inspector and the city authorities."

"One trouble is the condition of the downtown streets. Some one of them is ever torn up. The larger water mains promised on Grant street are not completed. The pink slip was done away with prematurely, and unless the Director completes the mains as promised the slip may be put on again. Our fire department is first-class and cannot be criticized."

* * * The lowest minimum rate for water in Cleveland for those whose assessment rates do not exceed \$4, permits the use of seven gallons for drinking drawn at the time of drinking, three complete flushings of water pipe from street to the faucet of three gallons at a flushing, seventy gallons for twenty flushings of closets and forty-two gallons for cleaning for each day for six months at a total cost of \$1.25.

Fire and Police Personals

—James Tead has been elected chief of the fire department of Yankton, S. D.

—Chief Henry Weimer, of Tiffin, O., has resigned on account of political reasons.

—The newly elected chief of the fire department of Hollis (L. I.), N. Y., John W. Hememan, has seen active service for fourteen years.

—Ex-Chief Joseph Swan, of Everett, Mass., fire department, died on December 7, of heart trouble, age eighty-four years.

—On November 30, Captain Morris Hawley, of Cleveland, O., fire department, retired after twenty-seven years of service, to enter business.

—Chief of Police Edward Norton, of Jersey Shore, Pa., died recently, from the effects of a kick in the stomach received while he was placing two men under arrest.

—Fireman William Miller, of the St. Louis fire department, was thrown under the wheels of a hose cart, that he was driving over a rough piece of road, and received fatal injuries.

—W. S. Bare was recently re-elected chief of the Bristol, Tenn., fire department. As a token of their appreciation the members of the fire department presented him with a gold ring.

—At a recent meeting of the Board of Aldermen of Lowell, Mass., it was voted that Chief Hosmer of the fire department should fill out the rest of the unexpired term. This ends the dispute which has been carried on for some time.

—Col. Fred W. Ames, ex-chief of police of Minneapolis, Minn., was pardoned by the State Board of Pardons, on December 20, having been convicted on October 1, 1902, of accepting a bribe while at the head of the Minneapolis department.

—Lawrence W. McGrath, the last fire commissioner of the old Morrisania, N. Y., volunteer fire department, died recently, at the age of sixty-six. He had been for seventeen years a fire marshal of New York, and was also a prominent politician.

—After forty-nine years of service in the fire department of Cambridge, Mass., Chief Thomas J. Casey has resigned to spend the rest of his life in retirement. Chief Casey is now nearly seventy-two years old and he retires with the respect, affection and best wishes of all his fellow citizens.

—Assistant Superintendent Kennelly and Inspectors Gray and Bailey of the Pittsburg police force have just returned from inspecting the police departments of the large eastern cities. The object of the trip was to gather useful information to be used in the betterment of the Pittsburg department.

—Assistant Fire Marshal William H. Townsend, of the Chicago fire department, has been compelled to retire on account of ill health. He has been in the service for nearly thirty-five years and leaves a fine record behind him. His successor will probably be Second Fire Marshal James Horan.

—On December 7, by a vote of 95 to 4, Chief George N. Parker was re-elected chief of the fire department of

Hudson, N. Y. He has seen active service for twenty-six years and has risen from the bottom to his present position. He is an able commander and is very popular with all the men under his command.

—Ex-Chief Howard F. Boyer, of the fire department, and one of the most prominent citizens of Reading, Pa., died recently, of pneumonia. He was sixty-five years of age. His funeral was one of the largest ever held in the city. It was attended by the whole fire department in command of Chief George W. Miller.

—Chief Samuel C. Snagg, of Waterbury, Conn., recently had a narrow escape from being drowned, at a fire. He was penned in behind a galvanized iron door at the foot of a stairway and the water from the different streams was quickly filling the space with water. At the time his cries were heard, the water was up to his chest.

—Chief William T. Belt, of the District of Columbia fire department, has been in the service for the last forty-three years. His advancement has been step by step, from the ranks and he has never had a single charge made against him. He did some effective work at the Baltimore fire last year. As chief he has received the highest commendation from the public, the press and the District Commissioners.

Telephones at Village Post-Offices

THE following account of a recent experiment by the British post-office department pertaining to village telephones, was clipped from a London paper:

"An important experiment, which may have far-reaching results, is being made by the telegraph department of the general post-office in half a dozen villages. The object is to ascertain if it is practicable to make village post-offices serve the purposes of public telephone call offices. If successful the result will be the removal of one of the disabilities attaching to life in villages.

"For the past six years, although the fact is not generally known, it has been the practise to use the telephone, which officially is a telegraph instrument, to transmit telegraph messages from town centers to small village post-offices. The installation of a telephone wire is cheaper than the telegraph installation, and the messages can be sent more expeditiously than by the needle instrument or the A B C code, the methods generally used in village post-offices. The messages are written out and stamped by the sender and are sent over the wire by the clerk.

"In the selected villages it is now possible for any member of the public to ring up a subscriber and use these post-office telephones in the ordinary manner at the ordinary rates. Should the person with whom communication is desired not be on the telephone line the sender can telephone his message to the nearest post-office and have it sent on by express messenger. In the case of long messages the saving in expense, as compared with sending the same message at telegraph rates, will be very considerable. Similarly, the town dweller will be able to communicate with the villager.

"The point to be decided is whether this new arrangement meets a real public want."

LITERATURE ON MUNICIPAL TOPICS*

Reviews of Some Important Books—What the Magazines and Reviews Have to Say About Civic Affairs—Municipal Reports Received

Books

THE MUNICIPAL JOURNAL has received a copy of the *Proceedings of the Chicago Conference for Good City Government and the Tenth Annual Meeting of the National Municipal League*, held April 27, 28 and 29, 1904. Mr. Clinton Rogers Woodruff is the editor, and the volume adds materially to the sum total of the League's information and literature on the various phases of the municipal problem. To use the words of William M. Ivins, author of "Machine Politics," in referring to a former volume of the League's *Proceedings*, "it will at once take an important place in the literature of municipal government. It is in itself most conclusive proof not only of the success, but of the value of the work which is being done by the National Municipal League."

The several papers on the subject of uniform Municipal accounting and statistics show not only the extent to which the League's schedules and work in this field have been availed of; and the experiences incident to their actual installation; but extend the careful consideration that has been given to this most important subject and prepare the ground for a volume, similar to the "Municipal Program," which will be at once a guide book and a manual for all engaged in the study of municipal affairs.

This volume, like its predecessors, is put forth with a sincere desire that it may prove to be useful and helpful to that growing number of Americans who appreciate the duty and necessity of giving of their time and energy for the elevation of American municipalities, and for combating the forces which are always tending to corrupt and debase them.

The Russian year book of statistics, finance and legislation, known as the *Bulletin Russe De Statistique Financière et De Legislation*, for July and August, 1904, is a clearly printed volume of 176 pages, containing much valuable information concerning Russian national finance, particularly with reference to the Russo-Japanese war. The bulletin will be especially valuable to bankers and financiers.

THE MUNICIPAL JOURNAL has received from Havana, Cuba, a number of timely and interesting brochures and other works on municipal matters by Professor Francisco Carrera Justiz, of the College of Municipal Government, and secretary of The Association for Good Government for the City of Havana. Among the works received are *Monopolies of Public Service*; *The Constitution of Cuba and Municipal Problems*; *Municipal Government in the United States*; *The Spaniards in Cuba*, and *Municipal Progress*. Professor Justiz is taking an active and intelligent part in the regeneration of the greater Havana, and of Cuba generally.

The Art of Wise Investing, is a little volume containing a

* Any book or periodical reviewed or mentioned in THE MUNICIPAL JOURNAL, or elsewhere, will be sent to any address on receipt of price.

series of short articles on investment values, pointing out the essential characteristics of safe investment securities, with a review of the financial pitfalls into which superficial examination inevitably leads. Cloth, 8vo., pp. 89. Moody Publishing Co., New York.

In *Accidents and Emergencies*, a small volume by Charles W. Dulles, M. D., the value of a cool head, a steady hand and some knowledge of what is best to be done in the presence of an accident, is pointed out. The volume is compiled with the hope of aiding any who wish to prepare themselves for such demands upon their own resources, and the suggestions are not elaborate, but simple and practicable. They do not pretend to take the place of calling a physician, but fill up with helpful action what might otherwise be a period of inaction and despair. Cloth, 8vo., pp. 209. Price, \$1.00 net.

Out of Work, by Frances A. Kellor, is a study of employment agencies: their treatment of the unemployed, and their influence upon homes and business. It is the record of practical investigations made in New York, Boston, Philadelphia and Chicago. The author and eight assistants visited several hundred employment agencies, both as employers and seeking positions as servants, teachers, stenographers, models, and general workers. The result showed that there are many existing abuses in the present system of employment agencies, and with the facts before them home-makers, business men and public officials can do much to improve conditions. Cloth, 8vo., pp. 292.

The *Scientific American Reference Book* for 1905, compiled by Albert A. Hopkins and A. Russell Bond is, as were its predecessors, a work comprehensive in character, containing a mass of information not readily procured elsewhere. The work has been made as non-technical as the subjects treated of will admit, and is compiled as a ready reference book for the home and office. Such interesting and important subjects as wireless telegraphy are treated clearly and comprehensively and brought up to date. Use of this work may save many fruitless searches through works of reference, as it contains matter not readily available elsewhere. Cloth, 12mo., 516 pp., illustrated, 6 colored plates. Price, \$1.50, postpaid.

The *Proceedings of the Twenty-fourth Annual Convention of the American Water Works Association*, which was held at St. Louis, June 6-11, 1904, has been published by the secretary, Mr. John M. Diven, Elmira, N. Y. The volume contains 585 pages, and is illustrated with maps and engravings. The work contains many papers of great interest and value, some of which have been reproduced in the columns of THE MUNICIPAL JOURNAL AND ENGINEER. It is noted that the next annual convention of the Association will be held at West Baden, Ind., May 11, 1905.

Reinforced Concrete, by Chas. F. Marsh, Assoc. M. Inst. C. E. and Inst. M. E. New York, D. Van Nostrand Co., 1904. Imp. 8vo., pp. 530, with 512 illustrations and diagrams. Price, \$7.00.

In this new and valuable contribution to engineering and architectural literature, the author has endeavored to present the subject in the most complete and exhaustive manner, using as a model the elaborate French treatises of Christophe (Le Beton Armé) and Berger & Guillerine (Ciment Armé). The first-named of these works the author regards as the standard of excellence, and has therefore drawn upon it copiously.

The matter has been carefully arranged so as to facilitate reference, and the portion relating to calculations embraces all forms of construction and has been presented in a concise and clear manner. The graphical method of finding the stresses in domes is believed to be entirely new and greatly simplifies the treatment of these structures.

The book is illustrated very fully and handsomely, and is cordially commended to all engineers, architects and builders who are interested in the new style of construction with concrete and steel.—[Reviewed by E. Kuichling.]

Articles in American Periodicals

The Arena, Trenton, N. J., December, 1904, contains, as a leading article, *How New Zealand is Solving the Problem of Popular Government*, by Edward Tregear, secretary of Labor for the Commonwealth of New Zealand. In the same number *The Building of the City Beautiful*, by Joaquin Miller, is started.

Government of Municipalities by Boards of Commissioners, by C. Arthur Williams, is published in the December, 1904, number of *Gunton's Magazine*, Washington, D. C. In speaking of Washington, the author says: "It is an interesting and significant fact that in what is admittedly the best governed municipality in this country the people have no voice in the selection of their officials and little or none, directly, in the general administration of public affairs. They may petition and suggest, but that is all."

Structural Details of the New Reinforced Concrete Bridge at Grand Rapids, Mich., by William F. Tubesing, is the leading article in *Engineering News*, New York, December, 1, 1904. There are several illustrations and diagrams of the bridge during construction and after it was completed.

For several years California has been using oil on its roads, with great success. In *The Engineering Record*, New York, December 3, 1904, an article on *The Oiled Roads of California* is begun. The same number also contains an illustrated article on *A Concrete-Steel Dam at Danville, Ky.* and an illustrated article on *Superstructures on the Weston Aqueduct of the Metropolitan Water Works.*

The Engineering Record, New York, December 17, 1904, contains an illustrated article on *The American System of Filtration Plant in Mysore, India*, by Edmund B. Weston, M. Am. Soc. C. E., M. Inst. C. E., of Providence, R. I. This plant is for supplying the Kobar Gold Field with potable water.

The Main Intercepting Sewers of Cleveland, Ohio, by Walter C. Parmley, is the leading article in the *Journal of the Association of Engineering Societies*, for November, 1904. It contains a number of diagrams and photographs. Mr. Parmley is a former president of the Civil Engineers' Club of Cleveland. The same number contains *Vital Statistics of St. Louis since 1840*, by Robert Moore. Price, \$3 per year, or 30 cents a copy, from J. C. Trautwine, Jr., secretary, 257 South Fourth street, Philadelphia.

Articles in Foreign Periodicals

Disposal of Municipal Refuse, by Rudolph Hering, M. Am. Soc. C. E., is published in *The Surveyor and Municipal and County Engineer*, London, Eng., October 14, 1904. Price, 3 pence.

Sewage Purification Works for Small Populations is the title of a paper read by A. J. Martin, Assoc. M. Inst. C. E., before the Institute of Sanitary Engineers. In the course of the paper Mr. Martin points out that the sewage from a manufacturing firm is more difficult to treat, sometimes, than the sewage of a large town. Disinfectants and grease in large quantities will also play havoc with a sewage purification plant. Published in *The Public Health Engineer*, London, Eng., October 15, 1904. Price, 3 pence.

Water, London, Eng., October 15, 1904, contains an article on *Copper and Water-Borne Typhoid*, by S. Rideal, D. Sc., Lond., F. I. C. and E. Baines, M. B. Camb., D. P. H. Camb. This is an interesting account of the effect that copper-sulphate has on algae and the proportions to use in order not to kill fish or to make it dangerous for drinking purposes. Price, 6 pence.

In *The Surveyor and Municipal and County Engineer*, London, Eng., November 11, 1904, is an illustrated article by Arthur Morris, entitled *Municipal Bordeaux*. Bordeaux is one of the important cities of France due, to a great extent, to its many natural advantages. A description of its municipal institutions will be of interest from the fact of the position it holds in France.

The leading article in *The Municipal Journal*, London, November 11, 1904, is, *Sanitary Progress at Leeds*. This article describes the two municipal hospitals recently completed at a cost of over \$1,800,000 and a picture of each is given.

A Record of the Baltimore Conflagration is the title of the first number of the *Journal of the British Fire Prevention Committee*. This Journal is to be issued quarterly and each number will deal with a subject relating to fire prevention.

The British Fire Prevention Committee, which has about 300 members, chiefly architects, surveyors and fire officers, is doing a good work in London. In 1899 it established the first independent testing station and up to the present time has carried on about eighty tests, with floors, partitions, doors and various appliances. The professional services in connection with these tests are rendered by the members, gratis.

In 1903 this committee organized the first International Fire Prevention Congress. There were 800 members enrolled, representing fifteen governments and over 200 muni-

cipalities. The result of this convention has been compiled in an extensive report. The committee is now collecting an international fire library, which will be used for reference purposes.

The Engineering Press Monthly Index Review, for September, is up to the usual standard of this able magazine, which contains the pith of the engineering journals of the world. This periodical, which was formerly the *Index of the Technical Press*, is published in Brussels in three languages. The price of a single number is one shilling.

Public Documents Received

THE twenty-second annual coal report of the Illinois Bureau of Labor Statistics. David Ross, Secretary.

The annual report of the Electrical Department of the District of Columbia for the year ending June 30, 1904. Warren C. Allen, Electrical Engineer.

The annual report of the Park Department of Cincinnati, O., for 1903. B. P. Critchell, Superintendent.

The annual reports of Boston, Mass., for 1902. Hon P. A. Collins, Mayor.

The testimony of J. W. Alvord in the case of the State of Missouri versus the State of Illinois and the Sanitary District of Chicago. John W. Alvord, Sanitary and Hydraulic Engineer of Chicago, Ill.

The annual reports of Charleston, S. C., for 1903. Hon. J. Adger Smith, Mayor.

The annual reports of Chelsea, Mass., for 1903. Hon. E. E. Willard, Mayor.

The annual reports of Davenport, Ia., for 1903. Hon. Waldo Becker, Mayor.

The annual reports of Louisville, Ky., for 1903. Hon. Charles F. Grainger, Mayor.

The annual reports of Newark, N. J., for 1903. Hon. Henry M. Doremus, Mayor.

The annual reports of St. Joseph, Mo., for 1903-4. Hon. W. E. Spratt, Mayor.

The annual reports of Salem, Mass., for 1903. Hon. Joseph N. Peterson, Mayor.

The bulletin of the Bureau of Labor for September, 1904, of the Department of Commerce and Labor, Washington, D. C. Hon. Carroll D. Wright, Commissioner.

The comptroller's report of Peoria, Ill., for 1903. William G. Olwin, Comptroller.

The annual report of the city of Davenport, Ia., for 1903. Hon. Waldo Becker, mayor.

The journal of the British Fire Prevention Committee for November, 1904, which is a record of the Baltimore conflagration of last year. Arranged by Edwin O. Sachs, F. R. S. Ed., chairman.

* * * The expense of each gas street lamp in Cleveland, O., under the contract system was \$22.56 per year. Under municipal management the cost is: Equipment, \$5.12; maintenance, \$7.66; gas, \$4.60, making a total of \$17.38, which is a saving of \$5.18 on each lamp, and of \$33,670 on the 6,500 lamps maintained. For vapor lighting the lamps cost \$22.37 under contract and for arc lamps \$75.

Milk Adulteration

WHILE the ordinary methods of milk adulteration are easily detected by expert examiners, it is reported that a French chemist, Dr. Quesneville, has made some experiments that point to the probability that for some time there has been practised a form of deception in milk adulteration which has escaped the attention of health officers. In a paragraph in the *Birmingham Daily Mail* it is explained that the deficiency of fats, whether due to the poverty of the milk or the extraction of fats, has been covered by the addition of foreign greasy matter. Dr. Quesneville found that "benzine would dissolve foreign fats without affecting the natural fats in milk," and thus by examining samples which have passed the ordinary test he discovered such substances as pork dripping and cocoanut butter.—Marshal Halstead, Consul, Birmingham, England.

Municipal Electric Tramways

AN important public improvement this year in Leicester is the installation of an electric street-car system in place of the horse-drawn cars. The old system extended nine miles; the new lines, when completed, will cover forty-two miles. The greater part is now equipped with overhead trolleys and is open to the public. It is a municipal undertaking. The largest tramway junction in the United Kingdom is at the clock tower, whence five sets of double track radiate. The fare from this point to any other on the line is 1 penny (2 cents), which pays for a journey, in some cases, of nearly three miles. The total cost of the system will be about \$3,250,000. For the first half of 1904 the net profits of the municipal gas works were \$110,000; of the electric light works, \$12,500, and of the water works, \$44,000. All this surplus goes to reduce taxes or to benefit the public in other ways.—Frank W. Mahin, Consul, Nottingham, England.

St. Louis to Increase Salaries

CHARTER amendments will be submitted to the voters of St. Louis at the election in April, for a \$9,000,000 bond issue and for increasing the salaries of the city officers about \$135,000 annually. It is proposed to increase the salary of the Mayor from \$5,000 to \$10,000; the Comptroller and President, B. P. I., from \$5,000 to \$8,000; Water Commissioner from \$4,500 to \$7,500; Street Commissioner and Sewer Commissioner, \$4,000 to \$7,500 President of the Council, from \$300 to \$3,000, and members of the Council and of House of Delegates from \$300 to \$2,500.

The salary amendments have been under consideration for some time, delay being caused by discussion on whether the amounts of increase should be stated specifically, which would make the change immediately effective, or whether a maximum should be named, which would throw the question to the Municipal Assembly, and cause a delay.

Mr. H. N. Davis, in favoring the appropriations, states: "That St. Louis has now a prestige which means a new awakening, and with the city going into wholesale improvements, there would be work for all and a keeping up of the strides which had been taken during the World's Fair period.

Concrete Street Curbs

CONCRETE Street Curbs first attracted public notice about fifteen years ago, but they seldom gave satisfaction because they developed two faults. First, the method of construction was often wrong, due largely to inexperience in concrete manipulation, and the form and foundation of the curb itself was frequently wrong, in not having sufficient depth and body, or in having a shallow foundation improperly designed. Second, the outer edges or corners of a concrete curb will not stand the use and abuse that a street curb is frequently subjected to, which makes some form of protected edge of the first importance.

The "Wainwright System" of Steel-Bound Concrete Curb seems to be the only mechanically correct method of accomplishing the desired result, and there are many reasons therefor.

The corner bar used in this system is the result of many years of experimentation and technical study, including interested criticisms from many of the foremost engineers in this country; the objects desired, being practical utility, non-expansibility, permanency, ornamentation, and practical economy.

The shape of a section of this corner bar is that of a T with a rounded head and a dovetailed web or stem, the head making a nicely rounded finish for the corner of the curb, and the stem of the T is permanently fixed in the concrete by the dovetailed web, the position of the bar being such that it carries and distributes in the most perfect manner the whole physical strain of any sudden load or contact; the bar, being galvanized, does not rust, but harmonizes closely in color with the concrete when the latter is properly colored with carbon.

A retaining frog is conveniently used in setting the bar in the concrete, which insures accuracy and proper position; uniformity being an important feature in this class of work.

Special attention is given to composition and manner of placing the concrete, as well as to the form, width and depth of the curb; a concrete curb should be not less than six inches wide at the top and should extend at least twelve inches below the gutter, with flaring base about six inches wider than the top; it should be laid with perpendicular face, and in finishing the face care should be taken not to add enough material to increase the thickness of the curb, or it will check and look badly and possibly scale off; the frames should never be removed until the concrete is set.

A complete and separating joint should be made at least once in every ten feet; the best method of doing this is to cut the concrete with a suitable instrument and to fill opening with sand, and then cut top finish through to the sand joint; when this is done the question of longitudinal expansion is eliminated; the corner bar used in the "Wainwright System" will not expand more than the concrete.

Many cities are using this up-to-date style of Steel-Bound Concrete Curbing, including Greater New York, Philadelphia, Baltimore, New Orleans, Mobile, and many others.

In 1899 about ten miles of this curbing was laid; in 1904 over one hundred miles was specified or contracted for, which shows its growing popularity, though it is only recently that its introduction has been pushed.

The Westinghouse World's Fair Turbine

A MEMORABLE incident of the morning following the close of the St. Louis Exposition was the formal shut-down and inspection of the 600-horse power Westinghouse steam turbine generating unit in the Palace of Machinery after a continuous run of over 3,962 hours—a performance which has had no parallel in steam turbine history. This machine was started on its long run at 9:20 o'clock on the morning of Monday, June 20, shortly after its installation at the Fair, and was stopped at 11:32 o'clock on the morning of Friday, December 2. During the five and a half months that the unit was in operation it supplied current for light and power throughout the Westinghouse exhibits in the Palaces of Machinery, Electricity and Transportation. Charles F. Foster, chief operating engineer of the Exposition; H. M. Holman, supervising engineer at the Govern-

ment Exposition gas engines tests, formerly president of the St. Louis Board of Public Works, and a number of Westinghouse representatives, including Wallace Franklin, of Detroit; C. C. Chappelle, of Chicago, and W. K. Dunlap, managing director of the Westinghouse exhibits, were present when the engine was stopped. It was found to be in perfect condition, and there were no signs of wear, the bearings still retaining the tool marks as they had come from the shops.

There have been at least two instances on record in America in which piston engines have been run continuously for about the same length of time as that of the record run of the Westinghouse turbine. The remarkable feature of the turbine run, of course, was the maintenance under load of a speed of 3,600 revolutions a minute for such a long period. From 8:30 o'clock in the morning to 10:30 o'clock in the evening, the load carried throughout the Exposition varied from 25 per cent. underload to 25 per cent. overload. The total number of revolutions almost touched the billion mark—855,792,000.

Plans Filing Cabinets

THE importance of having all valuable plans, charts and drawings used in a city engineer's office is just beginning to be appreciated, and the well-equipped and modern city hall is fitted throughout with fireproof furniture. The steel plan filing cabinets made by The Berger Manufacturing Company, Canton, O., are to be found in many city halls. The accompanying cut shows one of the many styles made by this Company.



STEEL PLAN FILING CABINET.

The advantages of steel furniture over wood would seem to be too well known to need repeating. This Company has, for the past decade or two, given its undivided attention to the production of appliances and decorative material in steel, and during that period the demand for its products has grown enormously. The catalogues for 1905 are now ready for mailing and will be sent to any address upon request. Ask for catalogue No. 3 S.

Imitation Bitulithic Not Acceptable

THE officials of Paris, Ky., some months ago made an extensive investigation of bitulithic pavement, as constructed by the Warren Brothers' Company, and became convinced of its merits, deciding to have some of this pavement laid in their city. When bids were advertised for, the specifications were drawn so as to admit of competition, and the officials, supposing that any contractor could construct a first-class bitulithic pavement, awarded the contract to a concern which slightly underbid the Warren Brothers' Company. The officials thought that the contractor's bond would insure the getting of a pavement equal to the bitulithic, although certain essential features of the Warren patents and system of construction were omitted, but the result of awarding the contract to the lowest bidder has been disastrous. The work has been wholly unsatisfactory, and demonstrates the fallacy of letting work to incompetent bidders simply because their bid is lower. *The Bourbon News*, of Paris, in commenting upon the work, said:

"After the new Main street has been washed off with the hose it don't look good, by any means, in a number of places. Even the stream of water has washed the gravel loose in places. Then the water stands in puddles here and there, which shows a defect in the grade. We are informed that about \$10,000 has already been paid on the street by the city, still they have not yet accepted the job, and the City Council should not accept it or pay another cent on it until the contractors make good. Persons who have seen this kind of street in other cities have always claimed that there should be another coating to go on Main street before it was completed, but it seems the contractor thought otherwise. It was the contractor's first job of building this kind of a street, we have often heard, and the street at least bears this rumor out. Nevertheless, it don't look good to us, and to a large number of citizens besides, and our city fathers should be careful in accepting it."

The *Paris Democrat* of December 19 gives an official report of the chairman of the improvement committee of the city council, showing that, although the pavement is only a month old, it already shows deplorable defects in every block, and that the work is not proper or acceptable.

Rubber Silicoat Roofing

TEN million square feet of Rubber Silicoat Roofing were used on the World's Fair buildings at St. Louis. This was the largest quantity of roofing material ever supplied by a single concern for exposition buildings.

The question of roofing such buildings is important, as they are constructed of light materials, the space to be covered is large, the exhibits must be absolutely protected from the weather and the material must be capable of being painted to bring out any desired color effects.

The Trinidad Asphalt Manufacturing Company, 320 South 21st street, St. Louis, Mo., was awarded the Grand Prize, a gold medal and a silver medal. Above is a cut of their unique exhibit representing the Globe covered with Roofing.

* * * August 1, 1903, the city of Cleveland took over the equipment of the contractor who had been disposing of the night soil at an expense of \$6,857 and at the close of the first five months the department showed net earnings of \$458.12. The work that had been left for the new superintendent to begin was the most difficult and in the most isolated localities, thus increasing the initial expense. It is confidently expected that the forthcoming report will show a more substantial balance to the credit of this department.

The Wager Timber Scale

THE Wager Timber Scale is a conveniently arranged double slide rule for computing the strength of wooden beams, based on the fiber stresses recommended by the American Association of Railway Superintendents. With its help most of the problems encountered in timber beam construction are quickly solved. Among these may be cited the following:—

(1) Given the depth, thickness and length of beams or joists of a certain kind of wood, also the load to be carried per square foot of floor surface, to find the proper distance between centers of timbers.

(2) Given the quality, length and spacing of the timbers to sustain a certain load per square foot of floor surface, to find their proper depth and thickness.

(3) Given the quality, span and dimensions of a timber, to find the load which it will sustain.

The use of this instrument is learned in a very short time, and it cannot fail to be appreciated by draftsmen.

Manufactured by the Wager Computing Scale Co., P. O. Box 539, Philadelphia, Pa. Price, \$1.00.



UNIQUE EXHIBIT OF TRINIDAD ASPHALT MANUFACTURING COMPANY AT WORLD'S FAIR, ST. LOUIS.

Trade Publications Received

—"Ye Olden Time Charcoal Iron" is the title of a 12-page booklet, just issued by the Berger Manufacturing Company, Canton, O. It is beautifully illustrated while the text tells a story that is interesting. A postal card request will bring one to your address.

—The C. O. Bartlett and Snow Company, Cleveland, O., have just issued a special "Gear Catalogue," No. 10, for 1905. It shows the different patterns for the various styles of gears made, such as spur, bevel, miter, angle and worm gears. The catalogue is illustrated. If a general catalogue is desired, ask for No. 11. Either, or both, will be sent to any address upon request.

—"Cement Buildings" is the title of a 48-page booklet published by The American Hydraulic Stone Company, Century Building, Denver, Col., which tells the process of manufacture and gives many illustrations of work done. In asking for this number mention the "Edition of November, 1904."

—The monthly "Book of Trains" of the Lake Shore and Michigan Southern Railway appears regularly in its attractive form. Besides containing all necessary information about trains, routes, etc., it has beautiful illustrations, including a famous view of Niagara Falls from the American side. For all information about the "Lake Shore" address A. J. Smith, General Passenger and Ticket Agent, Cleveland, O.

—Egyptian Portland Cement Company, Fenton, Mich., begins the New Year with an attractive illustrated 12-page catalogue, which can be had for the asking.

—The Marinette Gas Engine Company makes the well-known Walrath gas and gasoline engines, at Chicago Heights, Ill. Its catalogue for 1905 is now ready for mailing. Ask for catalogue H.

Map of New York City

THE passenger department of the New York Central & Hudson River Railroad has just issued a very interesting and useful map of New York City, embracing the bay, Hudson, East and Harlem Rivers. It shows an area of four miles from Grand Central Station in every direction. The names and location of seventy-seven hotels are given; also, the names and location of seventy-eight clubs and forty-nine theaters. The piers of the various lines of steamships are distinctly marked, as well as the numerous large and small parks located in various parts of Greater New York. The map is valuable to strangers visiting the "Wonder City" and can be obtained by sending a two-cent stamp to George H. Daniels, General Passenger Agent, Grand Central Station, New York City.—*From the Brooklyn Standard-Union.*

Items of Interest About the Trade

—THE Lake Shore and Michigan Southern Railway is always ready to answer questions about trains, routes, over its own or other roads. Time tables and full information about winter excursions, vacations and the like can be secured by addressing A. J. Smith, G. P. A., Cleveland, O.

—The H. Huennekes Company, 114 Liberty street, New York, engineers and contractors for sand-lime brick factories, "Huennekes System," were given the highest award in their class, by the Jury of Awards at the St. Louis World's Fair.

—The Otis Elevator Company shipped from Yonkers to the Grand Cathedral at Berlin, for the exclusive use of the German Emperor, one of its perfected and up-to-date electric elevators.

—The Pittsburg Terminal Clay Manufacturing Company, of Pittsburg, Pa., has been succeeded by the Federal Clay Products Co. Its products include sewer pipe, paving and sewer brick and electric conduits.

—Catalogue No. 35 of the Berger Manufacturing Company, Canton, O., will be found of interest by every one who has letters to file.

—The December issue of *Profitable Advertising* contains an interesting article entitled, "Preparation of Trade-Paper Advertisements," by Philip F. Kobbe, Jr., Advertising Manager of the Pneumatic Engineering Co., manufacturers of machinery for pumping water by compressed air.

—The De Laval Steam Turbine Company, Trenton, N. J., after a satisfactory test at its factory, shipped a 300-horse power steam turbine pump to the city of Rochester for use in the city water works. This pump was similar to that recently shipped to the Mt. Prospect pumping station, of Brooklyn, N. Y., a full description of which was given in the December number of the MUNICIPAL JOURNAL.

Public Utilities in Hull

THE construction of a municipal telephone system in Hull, England, has brought about a speedy reduction in rates. At a recent meeting of the corporation telephone committee it was announced that the charge for unlimited service over an exclusive line would be £5 (\$24.33) per annum to private houses and £6 6s. (\$30.65) to business premises. This reduction has been followed by a large increase in the number of subscribers. The National Telephone Company has been compelled to reduce its rates for unlimited service, so far as regards private houses, from

£10 (\$48.66) to half that amount. To what extent this reduction will affect the company in other towns and cities is a matter of interest. It is stated that in the agreements which the National Telephone Company has with practically all the large towns and cities in England, and by which the corporations of those towns granted the company underground way leaves, it was made a condition that in case they reduced their unlimited-service rate in any place below \$48.66, a similar reduction must be made, if demanded, in all other towns. If this is the case, then other cities can now demand the same telephone rate as is made in Hull. Thus the competition in this city may prove beneficial to every city in England.

A recent report of the comptroller of accounts of the Hull corporation throws some light on the position of other corporation enterprises and the success attending their municipalization. On account of the crematory \$530.44 was expended on the maintenance account and \$306.58 was received for the year ended April 1, so there was an excess of expenditure of \$223.86 in this case. On the public baths during the same time there was an excess of expenditure of \$1,110.53. In the gas department the profit shown on the year was \$15,380, from which there is to be deducted interest on the debit balance and the sinking-fund installment, leaving a net credit balance on the revenue account of \$2,637. The working profit of the waterworks was \$149,893; deducting \$12,652, city fund annuity; \$57,449, interest on loans, and \$8,622, sinking-fund installments, leaves the net profits \$71,162. The revenue account of the electric lighting shows a working profit of \$88,696, from which there are to be deductions for interest on loans, sinking-fund, and meter installments, leaving the net profit \$7,976. The working profit on account of the street cars for the year was \$185,238, from which \$48,329 is to be deducted for interest on loans and \$45,700 for sinking-fund installments, and \$37,400 to be transferred to the reserve fund, making the credit balance for this year \$57,500.

In each instance, then, with the exception of the crematory and the baths, the municipalization of public utilities in Hull has resulted in a profit to the city treasury. The profit, it is true, is small, but it must be remembered that the charges for these public services are extremely low. A ride on the street cars in any direction to the end of the line costs only 2 cents; an exclusive telephone service in a private house costs less than \$25 a year, and in a business office about \$30 a year. Gas is sold at 48 cents per thousand feet and electricity at 9 cents per unit. The object is not so much to make a profit for the city out of these utilities as to furnish the public with the best service at the lowest possible price. Viewed in this light, municipalization in Hull can be pronounced a success.—*Consular Reports.*

* * * The cost of cleaning the streets of Cleveland for fiscal year ending March 4, 1904, was \$150,126.30. Of this amount it cost \$3,861.90 to clean by flushing 702,192 square yards of pavement, or \$55 per 1,000 square yards; \$40,112.50 to clean 40,902,739 square yards with sweepers, \$90 per 1,000 square yards, and \$13,148.26 by "White Wings" to clean 2,160,000 square yards, or \$61 per 1,000 square yards.

CONTRACT NEWS FOR THE MONTH

Including Paving, Sewerage, Water Supply, Lighting, Public Buildings, Sewage and Garbage Disposal, Fire Supplies, Contracts Awarded

N. B.—All news of proposed work sent us by city officials is incorporated in our *Weekly Advance News Service* and appears subsequently in this "Contract News for the Month" if the date of the reception of bids be sufficiently late to warrant placing the item here.

City officials and others are urged to send us all news of contemplated improvements for use in our *Weekly Bulletins* which are mailed to those interested.

PAVING, PAVING MATERIAL AND MACHINERY

Albany, N. Y.—Contract will be awarded this winter for block asphalt pavement to be laid on South Pearl street.

Alexandria Bay, N. Y.—Plans are being prepared for twelve miles of boulevard to Clayton.

Baltimore, Md.—The following streets will be paved in 1905: North, Harlem avenues, Orleans and Gilmore streets with asphalt block; High street with Belgian block; Ensor street with vitrified block; total estimate \$144,500. Board of Estimates has approved appropriation of \$10,000 for asphalt block paving on Park avenue. Will repave Fayette, Calvert, Plaza and St. Paul streets.

Beaumont, Tex.—County Commissioners recently sold \$125,000 bonds for road improvements.

Bellingham, Wash.—Considering paving Elk street with vitrified brick, asphalt or fir blocks.

Camden, N. J.—Vine street and Seventh street will be paved with sheet asphalt.

Canandaigua, N. Y.—Recently voted by Board of Supervisors of Ontario county to construct 57 miles of good roads at an expense of \$400,000. Street Commissioners will buy 3 hand sweeping machines, 2 sprinkling wagons and may buy road scraper for macadam roads.

Center, Ind.—Will construct 2,552 lineal feet of brick road estimated at \$24,425.

Cincinnati, O.—Will pave Spafford, Bissell, Horace, Train, Clara, Mabel, Cleve, Superior, Ottawa, Compton, Reade streets, Waverly, Holton, Oak avenues and Noble court with vitrified brick; East Twelfth, Eighth, and Clark streets with asphalt; Vine street with granite block; Broadway with dressed Medina block.

Collingwood, O.—Plans and specifications being drawn for paving Collins avenue with brick.

Dallas, Tex.—Will issue \$500,000 bonds for good roads.

Davenport, Ia.—Will pave 22 streets with brick and asphalt, next year.

Dorranceton, Pa.—Recently voted to issue \$20,000 bonds for paving. Plans have been prepared for \$40,000 paving next year.

East St. Louis, Ill.—Bids wanted this winter or in the spring for 82,000 square yards of brick paving.

Escanaba, Mich.—Reported that \$50,000 bonds have been voted for street improvements.

Galveston, Tex.—Bids wanted for paving 13 blocks of streets with vitrified brick.

Glen's Falls, N. Y.—Considering the construction of a State road, 16 feet wide and 17 miles long, at an expense of \$190,000. Warren County Board of Supervisors.

Goshen, N. Y.—Board of Supervisors of Orange county will construct a \$75,750 State road to Tuxedo railroad station.

Grand Rapids, Mich.—Ordinance passed to pave North Union street with asphalt blocks on gravel and cobblestone base at an expense of \$14,750. Will also pave North Prospect street in the same way.

Hoboken, N. J.—Essex and Hudson counties have had plans pre-

pared for widening Plank road and will repave it with granite block in concrete, estimated to cost \$1,000,000.

Huntsville, Ala.—County Commissioners of Madison county are considering issuing \$100,000 bonds for repairing pikes.

Ironton, O.—May award contract in March, 1905, for 30,000 square yards of brick paving on Third street, estimated at \$75,000.

Jersey City, N. J.—Asphalt pavement may be laid on Carlton avenue.

La Crosse, Wis.—Will lay brick pavement on Main, Jay and Third streets.

Lansing, Mich.—May pave Walnut and Ottawa streets next spring.

Little Rock, Ark.—Will pave 41,000 square yards of streets, next year.

Louisville, Ky.—Plans are being prepared for a 40-foot asphalt pavement on Frankfort avenue, estimated at \$20,000.

Marion, Minn.—Reported to have voted \$24,425 bonds for street improvements.

Nashville, Tenn.—State may authorize city to issue \$150,000 to \$200,000 street improvement bonds.

Newark, N. J.—Board of Chosen Freeholders will pave Mt. Pleasant, Franklin, Bradford, South Orange avenues, Pier lane, Wall street and a road from Northfield church to Moorhousetown, aggregating 52,050 lineal feet.

Newark, O.—Ordinance passed on second reading to pave Woods avenue and may also pave Stanbarry street.

New Orleans, La.—The \$30,000 appropriation will be used for asphalt repair plant.

New York, N. Y.—Board of Aldermen has approved ordinance to appropriate \$73,000 corporate stock for widening and improving One-hundred and tenth street.

Norfolk, Va.—Ordinance has been passed to issue \$38,278 bonds for asphaltting Granby street, through the Sixth ward.

Philadelphia, Pa.—Highway Commission recommends the opening of parkway, estimated at \$4,386,400.

Poplarville, Fla.—County Commissioners will sell \$25,000 road improvement bonds.

Portsmouth, O.—Ordinance has been passed to issue \$25,000 for street improvements.

Racine, Wis.—Plans and specifications have been prepared for paving Douglas avenue with brick, at \$49,197.

Rome, N. Y.—\$20,000 street improvement bonds have been sold.

St. Augustine, Fla.—Considering paving King and Malaga streets with brick.

St. Louis, Mo.—City Council has passed ordinance to issue \$9,000,000 bonds for general improvements, of which \$2,000,000 will be spent on Kngs Highway boulevard system.

Salisbury, Md.—May expend \$20,000 on street improvements.

San Francisco, Cal.—\$16,750 will be spent on improving Ocean, Corbett, San Jose, Point Lobos, San Bruno avenues and Alamo square.

Seattle, Wash.—Considering paving 100 blocks of streets with asphalt and also 20 or 25 blocks on Third avenue. May pave 27 blocks on Second avenue with brick.

Sheboygan, Wis.—Plans are being prepared for paving 26,240 square yards of streets with brick on a concrete base and 25,000 square yards of granite top macadam pavement.

South Bend, Ind.—Plans are being prepared for 75,000 square yards of brick and asphalt paving and contracts will be awarded early in 1905.

Springfield, O.—Plans will be prepared for paving and sewerage Columbia street estimated at \$200,000.